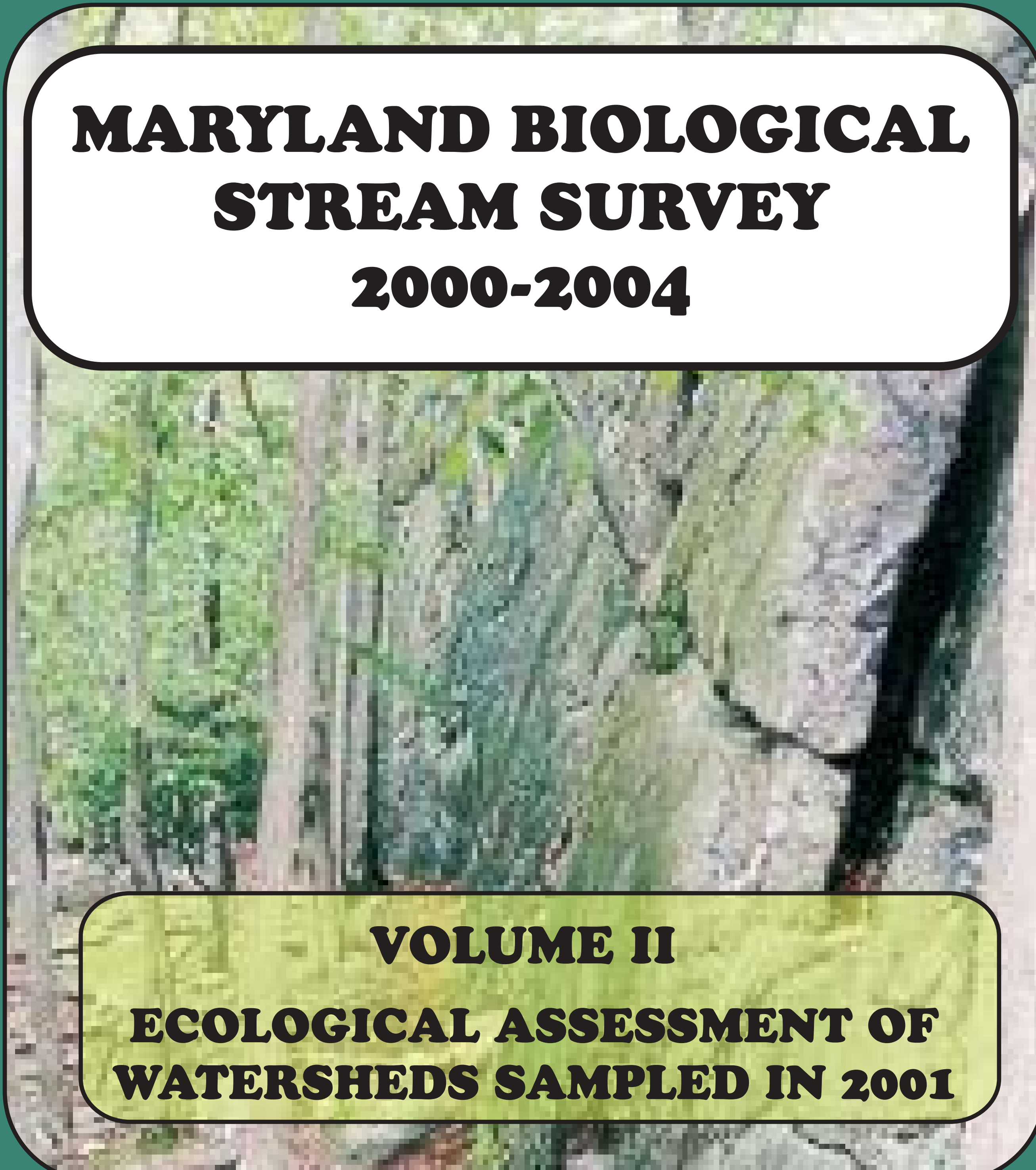
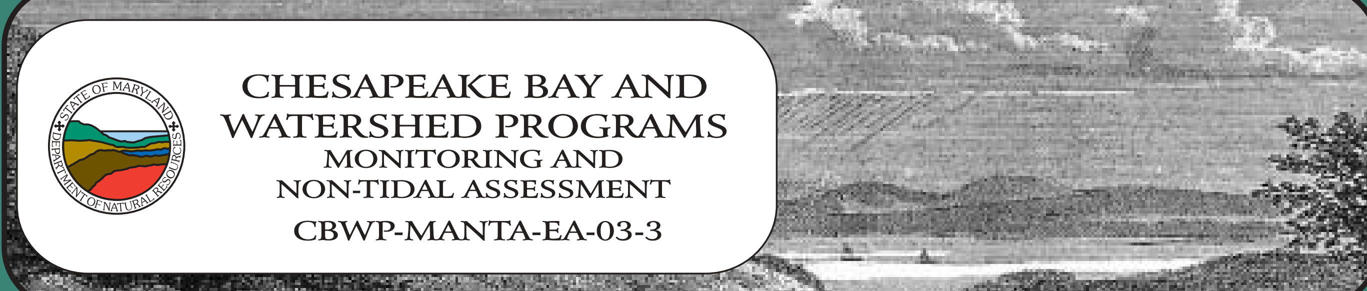
MARYLAND BIOLOGICAL STREAM SURVEY 2000-2004



VOLUME II

ECOLOGICAL ASSESSMENT OF WATERSHEDS SAMPLED IN 2001



CHESAPEAKE BAY AND
WATERSHED PROGRAMS
MONITORING AND
NON-TIDAL ASSESSMENT

CBWP-MANTA-EA-03-3

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STREAM SURVEY 2000-2004

Volume II: Ecological Assessment of Watersheds Sampled in 2001

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FOREWORD

This report, *Maryland Biological Stream Survey 2000-2004, Volume II: Ecological Assessment of Watersheds Sampled in 2001*, supports the Maryland Department of Natural Resources' Maryland Biological Stream Survey (MBSS) under the direction of Dr. Ronald Klauda and Mr. Paul Kazyak of the Monitoring and Non-tidal Assessment Division. Versar’s work and this report were prepared under Maryland's Power Plant Research Program (Contracts No. PR-96-055-001 and K00B0200109 to Versar, Inc.). A major goal of the MBSS is to assess the ecological condition of Maryland’s streams, with a particular focus on biological resources, but also evaluating water chemistry and physical habitat. Round Two of the MBSS was designed to characterize and assess watersheds over a five year cycle (2000-2004). This annual report presents results from watersheds sampled in 2001. This report includes a history of the program, a description of methods and survey design, comparative assessments by watershed, detailed results for individual watersheds, and comparisons with Round One results (from 1995-1997).

ACKNOWLEDGMENTS

The 2001 MBSS has been a cooperative effort among several agencies and consultants. We at Versar wish to thank Ronald Klauda and Paul Kazyak from the Maryland Department of Natural Resources (DNR) for directing the program and supporting Versar in preparing this report. DNR and the University of Maryland's Appalachian Laboratory (AL) each provided field crews and did a great job collecting the data. DNR digitized watersheds and calculated land use data, provided quality assurance, conducted crew training, and performed field sampling. Paul Kazyak and Tony Prochaska of DNR contributed to writing this report. Mark Southerland and Paul Kazyak served as its editors. Dr. Ray Morgan of the University of Maryland's Appalachian Laboratory supervised one field crew and oversaw water chemistry laboratory analysis. Dr. Rich Raesly of Frostburg State University provided taxonomic verifications of voucher fish specimens. Versar designed the sampling program, obtained landowners' permissions, conducted statistical analyses, and prepared this report.

The success of the project resulted from the strong efforts of all these groups. We particularly thank the key individuals listed below for their contributions:

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EXECUTIVE SUMMARY

This report presents the results of the second year of the second round of sampling conducted by the Maryland Biological Stream Survey (MBSS or the Survey) to assess the “state of the streams” throughout Maryland. The year 2001 was the second of five years of sampling planned for Round Two. Results for each year of Round Two will be reported annually and a summary report will be published when Round Two sampling is completed.

Background. Supported and led by the Maryland Department of Natural Resources (DNR), the MBSS is a comprehensive program to assess the status of biological resources in Maryland's non-tidal streams; quantify the extent to which acidic deposition affects critical biological resources in the state; examine which other water chemistry, physical habitat, and land use factors are important in explaining stream conditions; provide a statewide inventory of stream biota; establish a benchmark for long-term monitoring; and target future local-scale assessments and mitigation measures needed to restore degraded biological resources. To meet these and other objectives, the Survey has established a list of questions of interest to environmental decision makers to guide its design, implementation, and analysis. These questions fall into three categories: (1) characterizing biological resources and ecological conditions (such as the number of stream miles with pH $<$ 5), (2) assessing their condition, and (3) identifying likely sources of degradation.

To answer these questions, a number of steps have been taken since the Survey’s inception, including (1) devising a sampling design, (2) field testing sampling protocols and logistics to assure data quality and precision, (3) conducting an extensive, multi-year field sampling program, (4) developing reference-based indicators of biological integrity, and (5) using analytical methods to evaluate contributions of different anthropogenic stresses, including land use. Three characteristics of the Survey differentiate it from other stream monitoring efforts in Maryland. First, sampling is probability-based, allowing accurate and robust population estimates of variables and sampling variance, so that estimates of status can be made with quantifiable confidence. Second, the Survey focuses on biological responses to stress, but also collects data to characterize pollutant stress and habitat condition. Third, its scale is watershed-wide and statewide, rather than local.

MBSS Round Two Design. 2001 was the second year of sampling for Round Two of the Survey. Round Two includes both (1) a core survey based on statewide sampling of random stream segments and (2) ancillary sampling dedicated to additional monitoring and special studies. The core survey produces the majority of MBSS results and is the focus of this report. Some information gathered by the ancillary sampling is included, but extensive data analysis of these additional results is reserved for separate reports.

To meet the State’s growing need for information at finer spatial scales, Round Two’s core survey was redesigned to focus on Maryland’s 8-digit watersheds (averaging 75 mi^2 in area) rather than drainage basins (averaging 500 mi^2). The Round Two design is based on first-through fourth-order, non-tidal streams on a new 1:100,000-scale base map. The study design allows estimates at the level of 84 individual or combined Maryland 8-digit watersheds that serve as primary sampling units (PSUs). Each PSU has 10 or more sample sites. To achieve this sample density while sampling approximately 210 sites each year, Round Two will take five years to complete, running from 2000 through 2004 (rather than the three years in Round One, 1995-1997).

The MBSS uses a probability-based survey design called lattice sampling to schedule sampling statewide over a multi-year period. The lattice design of Round Two stratifies by year and PSU and restricts the sampling each year to about one-fifth of the state's 138 watersheds. Approximately 300 stream segments (210 in the core survey) of fixed length (75 m) are sampled each year, with biological, chemical, and physical parameters measured at each segment using standardized methods. Biological measurements include the abundance, size, and individual health of fish; taxa composition of benthic macroinvertebrates; and presence of amphibians and reptiles, mussels, and aquatic vegetation. Chemical analytes include pH, acid-neutralizing capacity (ANC), nitrogen, phosphorus, sulfate, chloride, conductivity, dissolved oxygen (DO), and dissolved organic carbon (DOC). Physical habitat parameters include commonly used observational measurements such as in stream habitat structure, embeddedness, pool and riffle quality, shading, and riparian vegetation, and quantitative measurements such as stream gradient, maximum depth, wetted width, and discharge. Channelization, bank erosion, bar formation, and land use immediately visible from the segment are assessed. Additional land use data for the entire catchment upstream of each sample site are incorporated from statewide geographic information system (GIS) coverages.

For the most part, methods used in Round Two are identical to those of Round One. However, some changes were made to improve the quality and/or usefulness of the data generated. These changes in sampling methods include (1) modifications to habitat assessment and characterization, (2) the addition of new chemical analytes (total dissolved nitrogen, total particulate nitrogen, nitrite nitrogen, ammonia, ortho-phosphate, total dissolved phosphorus, total particulate phosphorus, chloride, and turbidity), (3) collection of continuous temperature readings in the summer, (4) characterization of invasive plant abundance, and (5) the addition of altitude as a physical variable. In addition, the reach file used to select sites is the USGS 1:100,000-scale map; this is a change from the 1:250,000-scale map used in Round One, meaning that more small streams will be sampled in Round Two. Another change to the sample frame is the inclusion of fourth-order streams.

Although the Survey will provide the data needed to characterize the status of all 8-digit watersheds, it will not have sufficient sampling density to characterize most of the 1066 12-digit subwatersheds. Therefore, Round Two of the MBSS has been expanded to include coordination with volunteer efforts (such as DNR's Maryland Stream Waders) and County stream monitoring programs. Ultimately, by incorporating these data, the MBSS hopes to characterize many areas of the state at this finer spatial scale.

In addition to improving the spatial intensity of sampling, Round Two will address temporal variability by regular monitoring of fixed "sentinel" sites. In 2000, DNR established a network of approximately 25 sentinel sites deemed to be minimally impacted by human activities, in areas where land uses were unlikely to change over time (e.g., state parklands). With some modifications, these sites were again sampled in 2001, and will continued to be sampled throughout Round Two.

In 2001, 19 PSU's containing 212 sites were sampled. Ancillary sampling was conducted in 2001 to serve two additional purposes: (1) to collect additional data in cold-water streams to support indicator development for this stream type (16 new sites) and (2) to support Carroll County with three new sites in the Liberty Reservoir watershed.

MBSS 2001 Results. In 2001, the Survey continued to provide invaluable information on the abundance and distribution of rare species, in order to support a more thorough understanding of Maryland's biodiversity. During MBSS sampling in 2001, a number of occurrences of rare fish were documented, including one state-listed endangered species, glassy darter, and eight state-listed rare species: ironcolor shiner, logperch , mud sunfish, flier, banded sunfish, swamp darter, comely shiner, and shield darter.

The status of sampled watersheds and individual stream segments was assessed, focusing on the condition ratings of the fish and benthic Indices of Biotic Integrity (IBI), indicators previously developed by MBSS and employed in evaluating Round One results. IBI scores for each site were determined by comparing the fish or benthic assemblage to those found at minimally impacted reference sites.

IBI data for each PSU are depicted in box-and-whisker plots; mean IBIs for PSUs sampled in 2001 were mapped. Over the next three years of Round Two sampling, data will be collected in remaining PSUs to complete an updated statewide picture of biological conditions. Data were also used to estimate the extent of streams in poor to very poor condition (IBI < 3) within each PSU. The MBSS Round Two study design, based on simple random sampling, makes it possible to calculate an exact confidence interval around each estimate based on the binomial distribution. The extent of streams within a given condition (e.g., IBI < 3) is expressed as a percentage of all first-through fourth-order stream miles in the PSU, with an associated 90% confidence interval around the estimate.

The indicators used were developed during Round One of the MBSS and have been deemed reliable for representing ecological condition by field verification and expert peer review. Nonetheless, the MBSS continues to pursue refinements to its indicators including improvements to the provisional physical habitat index (PHI), methods for combining indicators that do not lose information (e.g., combined biotic index), and changes to the indicator thresholds and scoring methods to make them more intuitive and accessible to the public.

Fish IBI scores at sites sampled in the 2001 MBSS spanned the full range of biological condition, from 1.0 (very poor) to 5.0 (good). Mean fish IBI per PSU ranged from 1.90 (Potomac River Upper North Branch) to 3.86 (Little Gunpowder Falls). Fish IBI scores were less variable within some PSUs (e.g., Northeast River/Furnace Bay) than others (e.g., Potomac River Upper Tidal/Oxon Creek).

Benthic IBI scores spanned the full range of biological conditions, from 1.0 (very poor) to 4.78 (good). The lowest mean benthic IBI was 1.60 in Coastal Bays PSU. The highest mean benthic IBI was 4.17 in Prettyboy Reservoir PSU. Within-PSU variability ranged from low to high. The greatest extent of occurrence of streams with benthic IBI < 3 (expressed as 90% confidence intervals) was in Piscataway Creek (71 to 100% of stream miles), Potomac River Upper

Tidal/Oxon Creek (65 to 100%), and Coastal Bays (47 to 100%).

To integrate the results of fish and benthic IBI assessments, a Combined Biotic Index (CBI) was calculated as the mean of the fish and benthic IBI values at a site. If only one score was available (e.g., benthic but no fish IBI) the single score was assigned as the CBI. CBI scores from core MBSS sites ranged from 1.00 (very poor) to 4.60 (good). Mean CBI per PSU ranged from 1.96 (Coastal Bays) to 3.98 (Deer Creek), paralleling benthic IBI results.

The effects of acidic deposition and acid mine drainage (AMD) on stream chemistry are well documented. Round One MBSS results (Roth et al. 1999) and an assessment of these results in comparison with critical loads (Miller et al. 1998) confirmed that stream acidification remains a problem in Maryland freshwater streams. In 2001, estimates of the percentage of stream miles sensitive to acidification (i.e., those with ANC < 200 μeq/l) followed the geographic pattern noted in the MSSCS and Round One MBSS, with the greatest extent of acid-sensitive streams in Western Maryland and the Southern Coastal Plain. Seven PSUs, primarily in the same regions, had sites highly sensitive to acidification (ANC < 50 μeq/l). Also paralleling the Round One results, acidic deposition effects were more widespread than effects from acid mine drainage or agriculture.

Although many water resource programs tend to focus on water chemistry-based definitions of stream quality, physical habitat degradation can have an equal or greater effect on stream ecosystems and their biological communities. A provisional Physical Habitat Index (PHI), developed using earlier MBSS data (Hall et al. 1999) was used to score sites sampled in 2001. PHI scores varied widely within and among PSUs. The mean PHI fell into the range of good in two PSUs (Potomac Upper River North Branch and Youghiogheny River), while mean PHI was poor in one PSU (Bodkin Creek/Baltimore Harbor) and fair in the remaining 16 PSUs. Stream mile estimates of the occurrence of poor to very poor PHI scores suggest that physical habitat degradation is widespread.

MBSS 2001 results indicate that stream channelization is common in some Maryland watersheds, particularly in the Coastal Plain. Moderate to severe bank erosion also occurs commonly in Maryland streams. Mean values by PSU were used to estimate the extent of eroded area (square meters) per stream mile. Highest values were in Patuxent River Middle, Northeast River/Furnace Bay, Piscataway Creek, Seneca Creek, and Western Branch PSUs. The combined area of eroded bank in all 19 PSUs totaled more than 330 acres. Exacerbated bar formation was observed in most watersheds sampled in 2001. Lack of riparian vegetation on at least one stream bank was observed within 9 of 19 PSUs. Most watersheds of appeared particularly affected by the presence of exotic plants, such as multiflora rose, mile-a-minute, and Japanese honeysuckle. The total number of instream pieces of woody debris and rootwads was highest in Zekiah Swamp, due primarily to one site where 118 total instream woody debris and rootwads were counted.

During 2001, MBSS deployed continuous reading temperature loggers at more than 200 sites between the months of June and August. The long-term goal is to use temperature data to (1) better characterize coldwater streams and (2) identify streams stressed by temperature changes, such as spikes from rapid inputs of warm water running off impervious surfaces during summer storms. Among all sites assessed, mean average daily temperatures ranged from 12.8 to 24.8 °C, indicating the presence of both coldwater and warmwater sites in the data set. Future analyses of data from coldwater streams will assist in interpretation of IBI scores and will contribute to development of a fish IBI tailored to these systems, because trout and several non-game species require cool to cold waters. Fourteen sites had occasional readings above 32 °C, including Dividing Creek/ Nassawango Creek where the temperature exceeded 32 °C more than 2% of the time.

In Maryland, concern for nutrient loadings to the Chesapeake Bay has drawn attention to the amounts of nitrogen and phosphorus transported from throughout the watershed by streams. In MBSS 2001 sampling, total nitrogen tended to be highest in Central Maryland and the Eastern Shore. In general, nitrate nitrogen made up the largest fraction of total nitrogen. Nitrate nitrogen concentrations greater than 1 mg/l are commonly considered to indicate anthropogenic influence; mean nitrate nitrogen concentrations exceeded this level in 10 of 19 PSUs. In several PSUs, nearly 100% of stream miles had high nitrate nitrogen concentrations. Total phosphorus tended to be substantially higher on the Eastern Shore, lower in Western Maryland, and moderate in the central part of the state.

Dissolved oxygen concentrations at most locations were greater than 5 mg/l, the COMAR standard and a level generally considered healthy for aquatic life. The only PSU with a mean DO < 5 mg/l was Upper Pocomoke River, where swampy blackwater streams and sluggish waters are naturally lower in DO, but are also particularly susceptible to BOD loading from anthropogenic sources. Because sampling is done when the water is fairly clear, turbidity was generally low; a more complete characterization of turbidity would require sampling during storm events. Sulfate values were not generally high. Chloride tended to be highest in urban areas, especially Bodkin Creek/ Baltimore Harbor, and also at several sites near roadways that probably received substantial amounts of road salt. As expected, mean DOC and particulate carbon were highest in Coastal Plain basins, especially on the Eastern Shore.

Since the primary focus of the Round Two Survey is on smaller watersheds than in Round One, more attention has been paid to examining sampling results and potential stressors at individual sites. This report includes a snapshot of good and bad conditions that is illustrated by sites with the 10 best and 10 worst CBI scores. The report also includes a summary of results for each of the 19 PSUs sampled in the core (random) sampling for MBSS 2001. Each summary includes maps, land use statistics, and tables containing a variety of information on the sites sampled in each PSU. The benthic assessment results for the 708 sites sampled by the volunteer Stream Waders program in 2001 are also indicated on each map. In addition, the Seneca Creek map includes site assessment results for sites sampled by Montgomery County. These examples illustrate the Survey's efforts to incorporate data from other sources to provide more thorough monitoring coverage of Maryland's watersheds. Additional data for each PSU are available on a Web-based searchable database at www.dnr.state.md.us/streams.

As each round of statewide sampling by the Survey is conducted at regular intervals over time, temporal changes (trends) in the stream condition statewide or for individual 8-digit watersheds can be evaluated. A comparison with data from Round One (1995-1997) was conducted where sample sizes were sufficient (i.e., in the six 8-digit watersheds sampled in 2001 that also had more than 10 samples in one or two years of MBSS Round One). Yearly estimated 90% confidence intervals for fish or benthic IBI scores overlapped for all watersheds except for Deer Creek, which had an interval of 3.93 to 4.31 for the benthic IBI in 2001 as compared to the 3.31 to 3.81 interval in Round One sampling.

In 2000 the Survey initiated an annual monitoring effort at minimally disturbed sites (referred to as Sentinel sites) to help interpret the degree to which changes in biological indicator scores stem from natural variability. Sentinel sites are those most likely to remain undisturbed in the foreseeable future within four geographic regions o Maryland. In 2001, the original list of Sentinel sites was modified slightly and 26 sites were sampled. Although no more than three years of sampling is now available for any site, comparison of CBIs indicated that approximately 82% of all Sentinel sites varied less than 1.0.

Management Implications and Future Directions. The information being obtained by Round Two of the MBSS will continue to support a wide array of management decisions by Maryland DNR and other agencies. Major initiatives that have or will benefit from MBSS data include the Chesapeake Bay Agreement, Maryland Land Conservation, Clean Water Action Plan, State water quality standards, Maryland biodiversity, and other local monitoring programs.

The Survey results are expected to be highly useful for the new stream corridor commitments of the Chesapeake Bay Program. The Chesapeake 2000 Agreement (signed by Virginia, Maryland, Pennsylvania, District of Columbia, U.S. Environmental Protection Agency (EPA), and Chesapeake Bay Commission) newly recognizes "the need to focus on the individuality of each river, stream and creek" to meet the goal—"Preserve, protect and restore those habitats and natural areas that are vital to the survival and diversity of the living resources of the Bay and its rivers." The stream corridor information provided by the Survey will also prove invaluable for other statewide programs. As part of the Chesapeake Bay-wide goal of restoring 2,010 miles of riparian buffers in the Chesapeake Bay watershed by the year 2010, Maryland has committed to restoring 600 miles of riparian vegetation along its stream corridors. MBSS data on the condition of constituent streams will help assign priorities for the purchase of GreenPrint and Rural Legacy lands.

The results of Round Two will continue to support Maryland's participation in the federal Clean Water Action Plan. Round One MBSS data were an essential component of the first Unified Watershed Assessment, helping designate both Category 1 (priorities for restoration) and Category 3 (priorities for protection) watersheds within Maryland. Restoration strategies have been developed for many of these priority watersheds, and 2000 sampling results will be used to help implement them (e.g., in Little Patuxent River watershed). Because the design of Round Two focuses on the finer geographic scale of Maryland 8-digit watersheds, future Unified Watershed Assessments will be more complete.

In addition to supporting these targeting initiatives, the identification of degraded stream segments has implications for comprehensive protection under the Clean Water Act, including use of MBSS 2001 (along with other data) to prepare the State's Clean Water Act 303(d) list and biennial 305(b) water quality report. In particular, the Maryland Department of the Environment has developed an interim framework for the application of biocriteria in the State's water quality standards and list of impaired waters (303(d) list). At present, the proposed biocriteria for wadeable, non-tidal (first- to fourth-order) streams rely on two biological indicators from the MBSS, the fish and benthic IBIs. The approach centers on identifying impaired waterbodies at the Maryland 8-digit watershed and 12-digit subwatershed levels. Ultimately these MBSS biological data may also contribute to refinement of the States' aquatic life use designations.

The information on biological diversity collected by the Survey exceeds that needed to designate the ecological condition of individual watersheds. The extensive geo-graphic reach and quantitative sampling results of the Survey provide an unusual opportunity for evaluating the distribution and abundance of species previously designated as rare only by anecdotal evidence. For example, the endemic checkered sculpin and several other species have been collected in previously unreported locations. Based on the information gathered in Round One, Maryland DNR's Heritage and Biodiversity Programs are reevaluating state designations of rare, threatened, and endangered species.

One of the most promising trends related to the Survey has been the increase in interest and activity among Maryland county governments, non-governmental organizations, private businesses, and volunteers in stream monitoring. The success of the Survey has encouraged these groups to base their water resource management more directly on monitoring results. Many have instituted their own monitoring programs, often drawing upon or adopting MBSS sampling protocols. This report highlights the improved watershed coverage that can be obtained by incorporating volunteer Stream Waders data and the increased precision in stream assessments that can be attained by integrated MBSS data with that from local government monitoring programs such as Montgomery County. Maryland DNR expects to continue integration of the MBSS with those local government agencies that already have or are planning to initiate their own stream monitoring programs. The Maryland Water Monitoring Council (MWMC) will play an active role in encouraging collaborations between the state and local agencies.

As described above, the Round Two design provides significantly improved geographic resolution and additional stressor data, although more comprehensive understanding of watershed stressors will require data from other sources. Issues that require continued scrutiny in future years include the following:

- Extending the Survey into tidal streams
- Delineating more stream types requiring new indicators (e.g., coldwater and blackwater streams)
- Refining existing indicators (e.g., physical habitat) and developing new ones (e.g., streamside salamanders in small streams)
- Better characterization of existing and new stressors (e.g., estimating the contribution of eroded soil to sediment loading)
- Improving identification of rare species habitats and other biodiversity components
- Comparing among sample rounds for the detection of trends
- More coordination with counties for greater sample density or cost savings in areas of shared interest

In 2001, the Survey continued to make progress toward addressing these issues. Specifically, temperature loggers were deployed at nearly all randomly selected stream sites in 2000 and 2001 (and will continue to be deployed throughout Round Two) to improve our ability to identify coldwater streams. In both 2000 and 2001, 16 ancillary coldwater sites were sampled in both stressed and healthy coldwater streams. Analysis of existing coldwater and blackwater stream data has begun in hopes of developing separate reference conditions, and ultimately separate indicators, for these stream types. Two years of targeted sampling of MBSS streams for streamside salamanders have been completed in cooperation with the U.S. Geological Survey. Analysis of these data are underway and should determine whether it is feasible to use streamside salamander sampling in small MBSS streams as a second vertebrate indicator of condition for this stream type.

In 2001, the Survey also revisited its approach for assessing stream physical habitat quality, based on Round One data, by reanalyzing all existing physical habitat data and developing a new indicator. Following validation, this new PHI may be incorporated into MBSS analyses.

In 2001, the Survey had two papers accepted for publication in peer-review journals that address the issue of stressor diagnosis in freshwater streams. One study analyzed MBSS data in drainage basins of mixed land uses and determined that urban land use is a strong indicator of the likelihood that IBIs will fail biocriteria thresholds. In the other, the Survey developed an “expected species model” that diagnoses ecological stressors to stream fishes using species tolerances to 31 physical, chemical, and landscape variables. Like the other study, this approach found that impervious land cover was the most influential stressor on Maryland streams.

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1 INTRODUCTION

This report presents the results of the second year of the second round of sampling conducted by the Maryland Biological Stream Survey (MBSS or the Survey) to assess the "state of the streams" throughout Maryland. The year 2001 was the second of five years of sampling planned for Round Two. Sampling for the three-year Round One of the Survey was completed in 1997 and was summarized in Roth et al. (1999) and Boward et al. (1999). Results for each year of Round Two are reported annually and a summary report will be published when Round Two sampling is completed (for 2000 results, see Roth et al. 2001b). This introductory chapter describes the history of the Survey, describes its components, and provides a roadmap to this year 2001 annual report.

1.1 HISTORY OF THE MBSS

In the 1980s, the Maryland Department of Natural Resources (DNR) recognized that atmospheric deposition was one of the most important environmental problems resulting from the generation of electric power. The link between acidification of surface waters and acidic deposition resulting from pollutant emissions was well established and many studies pointed to adverse biological effects of low pH and acid neutralizing capacity (ANC) and elevated levels of inorganic aluminum. To determine the extent of acidification of Maryland streams resulting from acidic deposition, DNR conducted the Maryland Synoptic Stream Chemistry Survey (MSSCS) in 1987. The MSSCS estimated the number of streams affected by or sensitive to acidification statewide, concluding that the greatest concentration of fish resources at risk may be in streams throughout the Appalachian Plateau and Southern Coastal Plain physiographic provinces (Knapp et al. 1988).

While the MSSCS demonstrated the potential for adverse effects on biota from acidification, little direct information was available from the field on the biological responses of Maryland streams to water chemistry conditions. For this reason, in 1993, DNR created the MBSS to provide comprehensive information on the status of biological resources in Maryland streams and how they are affected by acidic deposition and other cumulative effects of anthropogenic stresses. The MBSS is now nine years old and continues to help environmental decision-makers protect and restore the natural resources of Maryland. The primary objectives of the MBSS are to

- assess the current status of biological resources in Maryland's non-tidal streams;
- quantify the extent to which acidic deposition has affected or may be affecting biological resources in the state;
- examine which other water chemistry, physical habitat, and land use factors are important in explaining the current status of biological resources in streams;
- provide a statewide inventory of stream biota;
- establish a benchmark for long-term monitoring of trends in these biological resources; and
- target future local-scale assessments and mitigation measures needed to restore degraded biological resources.

To meet these and other objectives of the MBSS, a list of 64 questions that the Survey will try to answer was developed. These questions fall into three categories: (1) characterizing biological resources, physical habitat, and water quality (such as the number of fish in a watershed or the number of stream miles with pH < 5); (2) assessing the condition of these resources (as deviation from minimally impaired expectations); and (3) identifying likely sources of degradation (by delineating relationships between biological conditions and anthropogenic stresses).

Answering these questions has required a progression of steps in the implementation of the Survey, including (1) devising a sampling design to monitor wadeable, non-tidal streams throughout the state and allow area-wide estimates of the extent of the biological resources, (2) implementing sampling protocols and quality assurance/quality control procedures to assure data quality and precision, (3) developing indicators of biological condition so that degradation can be evaluated as a deviation from reference expectations, and (4) using a variety of analytical methods to evaluate the relative contributions of different anthropogenic stresses.

In creating the Survey, DNR implemented a probability-based sampling design as a cost-effective way to characterize statewide stream resources. By randomly selecting sites, the Survey can make quantitative inferences about the characteristics of the more than 10,000 miles of non-tidal streams in Maryland. The EPA is encouraging the use of random sampling designs to assess status and trends in surface water quality (EPA 1993). The Round One MBSS design began with the MSSCS sample frame and was modified during the 1993 pilot and 1994 demonstration phases to provide answers to the questions of greatest interest (Vølstad et al. 1995, 1996). That design allowed robust estimates at the level of stream size (Strahler orders 1, 2, and 3), large watershed (17 river basins), and the entire state. Estimates by other categories, such as counties or smaller watersheds (138 in Maryland), were possible depending on the number of sample points in each unit. Round Two of the MBSS has a slightly different design that allows estimates at the level of smaller watersheds (85 individual or combined Maryland 8-digit watersheds); to achieve the necessary sample density at the available level of effort, Round Two will take five years to complete (rather than the three years in Round One).

DNR recognized that the utility of these estimates depended on accurately measuring appropriate attributes of streams. The Survey focuses on biology for two reasons: (1) organisms themselves have direct societal value and (2) biological communities integrate stresses over time and are a valuable and cost-effective means of assessing ecological integrity (i.e., the capacity of a resource to sustain its inherent potential). Inevitably, overall environmental degradation is tied to a failure of the system to support biological processes at a desired level (Karr 1993). It is equally important to recognize that the natural variability in biota requires that several components of the biological system be monitored. Fish are an important component of stream integrity and one that also contributes substantial recreational values. The Survey collects quantitative data for the calculation of population estimates for individual fish species (both game and nongame). These data can also be used to evaluate fish community composition, individual fish health, and the geographic distribution of commercially important, rare, or non-indigenous fish species. Benthic (bottom-dwelling) macroinvertebrates are another essential component of streams and they constitute the second principal focus of the Survey. The Survey uses rapid bioassessment procedures for collecting benthic macroinvertebrates; these semi-quantitative methods permit comparisons of relative abundance and community composition, and have proven to be an effective way of assessing biological integrity in streams (Hilsenhoff 1987, Lenat 1988, Plafkin et al. 1989, Kerans and Karr 1994, Resh 1995, Barbour et al. 1999). The Survey also records the presence of amphibians and reptiles (herpetofauna), freshwater mussels, and aquatic plants (both submerged aquatic vegetation (SAV) and emergent macrophytes). The Survey has established rigorous protocols (Kazyak 2001) for each of these sampling components, as well as training and auditing procedures to assure that data quality objectives are met.

Although the MBSS sampling design and protocols provide exceptional information for characterizing the stream resources in Maryland, designation of degraded areas and identification of likely stresses requires additional activities. Assessing the condition of biological resources (whether they are degraded or undegraded) requires the development of ecological indicators that permit the comparison of sampled segment results to minimally impacted reference conditions (i.e., the biological community expected in watersheds with little or no human-induced impacts). The Survey has used its growing database of information collected with consistent methods and broad coverage across the state to develop and test indicators of individual biological components (i.e., fish and benthic macroinvertebrates) and a provisional indicator of physical habitat quality (Roth et al. 2000, Stribling et al. 1998, Hall et al. 1999). These three indices are the basis for estimating the number of stream miles in varying degrees of degradation (good, fair, poor, and very poor condition) and mapping the locations of sites by their condition. Each of these indicators consists of multiple metrics using the general approach developed for the Index of Biotic Integrity (IBI) (Karr et al. 1986, Karr 1991) and the Chesapeake Bay Benthic Restoration Goals (Ranasinghe et al. 1994). The fish and benthic IBIs (which combine attributes of both the number and the type of species found) are widely accepted indicators that have been adapted for use in a variety of geographic locations (Miller et al. 1988, Cairns and Pratt 1993, Simon 1999). The Survey currently reports a composite fish and benthic indicator (Combined Biotic Index, or CBI) and is investigating the possibility of developing additional indicators (e.g., salamanders in small streams with few or no fish).

In addition to using reference-based indicators, the Survey applies a variety of analytical methods to the question of which stresses are most closely associated with degraded streams. This involves correlational and multivariate analyses of water chemistry, physical habitat, land use, and biological information (e.g., presence of non-native species). The biological information also provides an unusual opportunity for evaluating the status of biodiversity across the state; the distribution and abundance of species previously designated as rare only by anecdotal evidence can be determined and unique combinations of species at the ecosystem and landscape levels can be identified. Land use and other landscape-scale metrics also play an important role in identifying the relative contributions of different stresses to the cumulative impact on stream resources. Ultimately, the Survey seeks to provide an integrated assessment of the problems facing Maryland streams that will facilitate interdisciplinary solutions.

The research progress and assessment results of Round One of the MBSS are reported in Roth et al. (1999) and Boward et al. (1999). Among other findings, Round One collected 83 fish species, including rare occurrences of the endemic checkered sculpin and non-native cutthroat trout. According to the fish IBI, 45% of stream miles fell into the range of good to fair, while 49% fell into this range according to the benthic IBI. Similarly, 49% of stream miles were rated good to fair by the physical habitat index. Statewide, 28% of stream miles were acidic or acid sensitive, indicating a slight improvement since the 1987 MSSCS. Acidic deposition was by far the most common source of stream acidification, dominating 19% of stream miles. Statewide, 59% of stream miles had nitrate-nitrogen concentration greater than 1.0 mg/l, indicating anthropogenic sources. Nearly all sites with greater than 50% urban land use had IBI scores indicative of poor to very poor biological condition. These and other results are already being used by Maryland DNR to target resource management efforts and to reevaluate state designations of rare, threatened, and endangered species. MBSS Round One Results have also been used to support Maryland's Unified Watershed Assessment and other components of the Federal Clean Water Action Plan, the Maryland Tributary Strategy Teams' plans to reduce nutrient contributions to the Chesapeake Bay, and the Maryland Department of the Environment's water quality standards program that lists impaired waters and develops total maximum daily loads (TMDLs). Round Two of the Survey will continue to contribute to these activities and, by refining the assessment of watershed conditions, may provide even greater utility to managers.

1.2 ROUND TWO OF THE MBSS

2000 was the first year of sampling for Round Two of the Survey. Results from 2000 can be found in Roth et al. (2001b). Round Two is a natural extension of the MBSS as it began in 1993 and it includes both (1) a core survey based on statewide sampling of random stream segments and (2) ancillary targeted sampling dedicated to additional monitoring and special studies. The core survey produces the majority of MBSS results and is the focus of this report. The information gathered by the ancillary sampling is included where convenient for completeness, but extensive data analysis of these additional results is reserved for separate reports (but see Chapter 6 on Sentinel Site sampling).

To meet the state's growing need for information at finer spatial scales, Round Two's core survey was redesigned to focus on Maryland's 8-digit watersheds (Table 1-1). The Round Two design was also based on a new 1:100,000-scale base map; this means that more small streams will be sampled than were sampled in Round One. Specifically, Round Two's design allows estimates at the level of 85 individual or combined Maryland 8-digit watersheds by ensuring that each watershed has 10 or more sample sites. To achieve this sample density at the same annual level of effort, Round Two will take five years to complete (rather than the three years in Round One), running from 2000 through 2004. The details of the Round Two study design are presented Section 2.2 of this report.

The results of Round Two's core survey will be presented in much the same way as for Round One. Unusual or rare or important species will be included to highlight our improving understanding of the state's biodiversity. The status of sampled watersheds and individual stream segments will be reported, focusing on the conditions ratings of the fish and benthic IBI. Stressor results (for acidification, physical habitat, and nutrients) will be reported within and among watersheds. The 2001 report will also present preliminary comparisons with the Round One data and begin to discuss trends in the condition of Maryland's streams. Individual sites' results for each watershed will be included, with additional information available on a Web-based searchable database at www.dnr.state.md.us/streams. The sampling frame for Round Two is based on a 1:100,000 scale map, and includes a substantial number of streams (primarily first-order) that were not included in the sampling frame used for Round One (1:250,000 map). In the estimation of differences in statewide stream condition between the two rounds, the bias resulting from differences in sampling frames can be corrected for by limiting the analysis to the population of streams that overlaps for the two sampling frames. The difference in map scale is likely to have

Table 1-1. Relative sizes of United States Geological Survey (USGS) and Maryland hydrologic units

	USGS 8-digit Cataloging Unit (MD 6-digit Basin)	**MD 8-digit Watershed**	**MD 12-digit Subwatershed**
Number in Maryland	20	138	1066
Average size in Maryland (approx.)	500 sq. mi.	75 sq. mi.	8 sq. mi.

only a small effect on parameters such as the mean IBI scores because the IBI scoring method is calibrated to adjust for effects of stream size on the expected number of species and other metrics. Results in Vølstad et al. (2001) suggest the mean fish IBI scores for an 8-digit watershed in Montgomery County (Seneca Creek) based on the County survey (1:24,000 map scale) is similar to the mean score based on the MBSS (1:100,000 scale).

While the data obtained from Round Two can still be aggregated to characterize basin or statewide conditions, the new design was intended primarily to provide estimates of stream condition at the smaller watershed level needed by many of the State's watershed assessment and management programs and by local governments. For example, both the State's Unified Watershed Assessment / Clean Water Action Plan and its interim biological criteria framework for non-tidal streams (MDE 2000) employ data to assess and rank Maryland 8-digit watersheds. The interim biocriteria framework for Maryland incorporates stream ratings based on fish and benthic IBIs developed by the MBSS (Roth et al. 2000, Stribling et al. 1998) to identify 8-digit watersheds and 12-digit subwatersheds that are impaired. Results from MBSS 2000 will be used to prepare the State's Clean Water Act 303(d) list and 305(b) water quality report.

Although the Survey will provide the data needed to characterize the status of all 8-digit watersheds (averaging 75 mi^2 in area), it will not have sufficient sampling density to characterize most of the 1066 smaller 12-digit subwatersheds (averaging 8 mi^2 in area). Therefore, Round Two of the MBSS has been expanded by DNR to include a new volunteer effort (Maryland Stream Waders) and closer coordination with County stream monitoring programs. Maryland DNR is evaluating the feasibility of integrating data from these other monitoring programs by studying the comparability of each program's sampling and analytical methods. By incorporating these data, the MBSS hopes to characterize many areas of the state at this finer spatial scale.

In 2000, Maryland DNR launched its volunteer-based Maryland Stream Waders initiative, a benthic sampling program. Each volunteer was trained by Maryland DNR staff in methods documented in the Maryland Stream Waders stream sampling manual (Boward 2000) and quality was assured through 5% duplicate sampling, taxonomic confirmations, and laboratory subsampling. In 2001, volunteers sampled 708 sites within the same watersheds sampled by MBSS crews. A benthic family-level IBI was calculated for these sites (MDNR 2000). Stream Wader results are presented in Chapter 4 of this report. For further information on Stream Waders, see http://www.dnr.state.md.us/streams/mbss/mbss_volun. html. The goals of the program are to:

- increase the density of sampling sites for use in stream quality assessments;

- improve stream stewardship ethics and encourage local action to improve watershed management;

- educate local communities about the relationship between land use and stream quality; and

- provide quality-assured information on stream quality to state, local, and federal agencies, environmental organizations, and others.

At the same time, Maryland DNR is working with several County (and Baltimore City) stream monitoring programs to coordinate monitoring and assessment efforts. Issues of study design, site selection, comparability of field and laboratory protocols, quality control, and integrated analysis are being addressed as cooperative efforts with the counties. For example, the MBSS and Montgomery County Department of Environmental Protection recently completed a EPA-sponsored case study that outlines general guidelines for integrating state and county programs (Roth et al. 2001a). Currently, the MBSS is also working with the Prince George's County, Howard County, and Baltimore County/City (using Maryland Save Our Streams) programs. Where feasible, the more spatially intensive monitoring results from the counties will be incorporated into MBSS reporting. Both state and county stream monitoring programs may also realize cost savings by sharing sampling results.

In addition to improving the spatial intensity of sampling, Round Two will address temporal variability by regular monitoring of fixed "sentinel" sites. In 2000, DNR established a network of sentinel sites deemed to be minimally impacted by human activities. A total of 25 sentinel sites were selected in areas where land uses were unlikely to change over time (e.g., state parklands) from a pool of least-impacted reference sites identified in Round One (i.e., sites meeting designated water chemistry, physical habitat, and land use criteria). Chapter 6 of this report describes sampling efforts at the Sentinel sites in 2001.

Another 16 coldwater sites were sampled in 2001 to provide additional data from both stressed and healthy coldwater streams that can be used in the future development of a coldwater fish IBI. In addition, three sites were sampled in the Liberty Reservoir watershed during 2001 at the request of Carroll County government.

1.3 ROADMAP TO THIS REPORT

This report presents the results of the 2001 annual sampling of Round Two of the MBSS and includes 8 chapters and 4 appendices. Chapter 2 provides a general description of the overall sampling design used in Round Two and describes the specific survey methods used. Chapter 2 also includes a brief description of the field and laboratory protocols and the statistical methods used in data analysis. Chapter 3 provides a comparative assessment of the watersheds sampled in 2000. Separate sections in Chapter 3 focus on biodiversity, biological indicator results, and three predominant issues affecting biological resources: acidification, physical habitat, and nutrients. Chapter 4 summarizes the sampling results for individual watersheds with tabular and map data. Chapter 5 compares the results of the 2001 sampling with Round One (1995-1997) of the Survey. Chapter 6 provides the results of sampling at MBSS sentinel sites. The conclusions of this report are presented in Chapter 7, focusing on management implications, dominant stressors, and emerging trends. References are in Chapter 8, while summary data tables and weather information are in the Appendices.

2 METHODS

2.1 BACKGROUND

This chapter presents the study design and procedures used to implement Round Two of the Maryland Biological Stream Survey (MBSS or the Survey). Details of the study design and sample frame are included below, along with a summary of landowner permission results and the number of sites sampled in watersheds selected for sampling in 2001. This background material is followed by a summary of field and laboratory methods for each component: water chemistry, benthic macroinvertebrates, fish, amphibians and reptiles, vegetation, and physical habitat. Quality assurance (QA) activities are also described. For further details on Round Two methods, see the MBSS Sampling Manual (Kazyak 2001).

For the most part, methods used in Round Two of the MBSS (2000-2004) are identical to those of Round One (1995-1997). However, some changes were made to improve the quality and/or usefulness of the data generated. These changes in sampling methods include (1) modifications to the physical habitat assessment and characterization, (2) the addition of new chemical analytes (total nitrogen, nitrite, ammonia, ortho-phosphate, total phosphorous, chloride, and turbidity), (3) collection of continuous in-stream temperature readings at all randomly-selected sample sites throughout the summer, and (4) characterization of invasive terrestrial plant abundance. In addition, the reach file used to select sites is the 1:100,000-scale map developed by USGS; this is a change from the 1:250,000-scale map used in Round One. Another change to the sample frame, is the expansion of the Survey to include fourth-order, non-tidal streams.

2.2 STATISTICAL METHODS

2.2.1 Survey Design

The second round of the MBSS is being conducted over five years starting in the year 2000. The Round Two Survey was designed to provide an assessment of stream condition in each of the Maryland 8-digit watersheds that contain non-tidal streams. It also facilitates the assessment of average stream condition over the five-year period for (1) the entire state, (2) the 17 major (Maryland 6-digit) drainage basins, and (3) other areas of interest such as counties and regions. The design was subject to the following level-of-effort constraints: (1) that a maximum of 300 sites be sampled per year, with approximately 210 allocated to the core random design, and (2) that the maximum sampling interval be 5 years.

2.2.2 Sample Frame

The sample frame for the 2000-2004 MBSS is based on the 1:100,000-scale stream network, a map scale consistent with that used by EPA and other states. The frame was constructed by overlaying the 138 Maryland 8-digit watershed boundaries (Figure 2-1) on a map of all stream reaches in the study area as digitized on a U.S. Geological Survey 1:100,000-scale map. It includes all non-tidal stream reaches of fourth-order and smaller, excluding impoundments that are non-wadeable or that substantially alter the riverine nature of the reach (see Kazyak 1994). Fourth-order streams were included to ensure that all the streams classified as third-order by the 1:250,000 map (and sampled in the 1995-1997 MBSS) were also covered in the 2000-2004 MBSS. Four 8-digit watersheds (Atlantic Ocean, plus the Upper, Middle, and Lower Chesapeake Bay) were excluded from the sample frame because they describe marine/estuarine waters and do not contain non-tidal streams. Of the 134 watersheds included in the frame, 79 contained less than 100 non-tidal stream miles each; these were combined into 29 "super-watersheds" with between 2 and 7 constituent 8-digit watersheds each. When combined with the 55 remaining "stand alone" watersheds, a total of 84 watersheds of concern were identified as discrete sampling units for the Round Two (Table 2-1).

The Strahler convention (Strahler 1957) was used for identifying stream reaches in each 8-digit watershed by order. First order reaches, for example, are the most upstream reaches in the branching stream system. The designation of stream order for a particular reach depends on the scale and accuracy of the map.

2.2.3 Sample Selection

The second round of MBSS was restricted to a maximum of 300 sampling sites per year (210 within the core survey). Hence, it was not practical to stratify the network of streams in Maryland by 8-digit watersheds and sample them annually

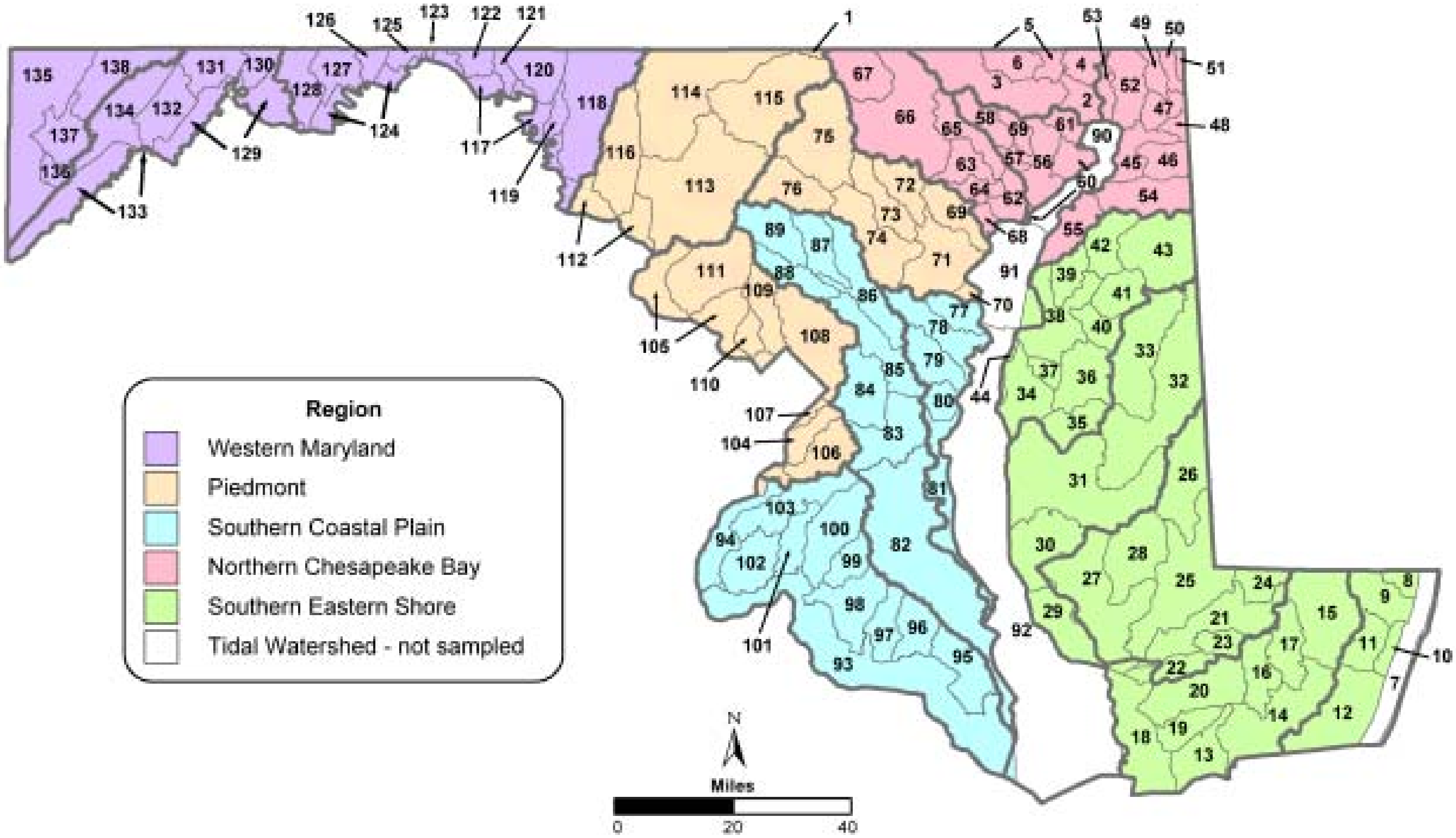


Figure 2-1. Maryland 8-digit watersheds by region

Table 2-1. Maryland individual and combined watersheds (primary sampling units or PSUs) to be sampled in the 2000-2004 MBSS.
* indicates watershed selected that year for repeated sampling

Basin	Watershed	Watershed Number	2000	2001	2002	2003	2004	Extra Sites
Youghiogheny	Youghiogheny River	135		X				6
	Little Youghiogheny/Deep Creek Lake	136/137					X	
	Casselman River	138	X					
North Branch Potomac	Potomac River Lower North Branch	129				X		5
	Evitts Creek	130					X	
	Wills Creek	131					X	
	Georges Creek	132				X		
	Potomac River Upper North Branch	133		X				
	Savage River	134			X			4
Upper Potomac	Antietam Creek	118				X		4
	Potomac WA Co/Marsh Run/Tonoloway/Little Tonoloway	117/119/123/125	X		*			3
	Conococheague	120			X			
	Little Conococheague/Licking Creek	121/122					X	
	Potomac AL Co/Sideling Hill Creek	124/126		X				
	Fifteen Mile Creek	127	X					
	Town Creek	128	*		X			
Middle Potomac	Potomac River FR Co	112					X	
	Lower Monocacy River	113				X		11
	Upper Monocacy River	114	X					8
	Conewago Creek/Double Pipe Creek	1/115			X			7
	Catoctin Creek	116				X		4
Potomac Wash Metro	Potomac River MO Co	105			X			5
	Piscataway Creek	106		X				
	Potomac Upper Tidal/Oxon Creek	104/107		X				
	Anacostia River	108					X	5
	Rock Creek/Cabin John Creek	109/110				X		
	Seneca Creek	111		X				5

Table 2-1. (Continued)

Basin	Watershed	Watershed Number	2000	2001	2002	2003	2004	Extra Sites
Patapsco	Back River	69			X			
	Bodkin Creek/Baltimore Harbor	70/71		X			*	
	Jones Falls	72			X			
	Gwynns Falls	73					X	
	Patapsco River Lower North Branch	74	X					4
	Liberty Reservoir	75	X			*		5
	South Branch Patapsco	76	X					
Patuxent	Little Patuxent River	86	X					3
	Middle Patuxent River	87			X			
	Rocky Gorge Dam	88			X			
	Brighton Dam	89	X					
	Patuxent River Lower	82					X	8
	Patuxent River Middle	83		X				3
	Western Branch	84		X				
	Patuxent River Upper	85					X	
Lower Potomac	Breton/St. Clements Bays	96/97			X			
	Potomac Lower Tidal/Potomac Middle Tidal	93/94			*		X	
	St. Mary's River	95	*			X		
	Wicomico River	98					X	
	Gilbert Swamp	99		X				
	Zekiah Swamp	100		X				3
	Port Tobacco River	101				X		
	Nanjemoy Creek	102	X					
	Mattawoman Creek	103	X					
West Chesapeake	Magothy River/Severn River	77/78				X		
	South River/West River	79/80			X			
	West Chesapeake Bay	81				X		
Gunpowder	Gunpowder River/Lower Gunpowder Falls/Bird River/ Middle River-Browns	62/63/64/68			X			
	Little Gunpowder Falls	65		*		X		
	Loch Raven Reservoir	66			X			7
	Prettyboy Reservoir	67	X					

Table 2-1. (Continued)

Basin	Watershed	Watershed Number	2000	2001	2002	2003	2004	Extra Sites
Susquehanna	Lower Susquehanna/Octoraro Creek/Conowingo Dam Susquehanna	2/4/5					X	
	Deer Creek	3		X			*	4
	Broad Creek	6				X		
Bush	Aberdeen Proving Ground/Swan Creek	60/61	X					
	Lower Winters Run/Atkisson Reservoir	57/58					X	
	Bush River/Bynum Run	56/59					X	
Elk	Northeast River/Furnace Bay	52/53		X				
	Lower Elk River/Bohemia River/Upper Elk River/Back Creek/Little Elk Creek/Big Elk Creek/Christina River	45/46/47/48/49/50/51				X		
	Sassafras River/Stillpond-Fairlee	54/55		X				
Chester	Eastern Bay/Kent Narrows/Lower Chester River/ Langford Creek/Kent Island Bay	34/37/38/39/44			X			
	Miles River/Wye River	35/36				X		
	Corsica River/Southeast Creek	40/41	X					
	Middle Chester River	42			X	*		
	Upper Chester River	43					X	
Choptank	Honga River/Little Choptank/Lower Choptank	29/30/31				X		
	Upper Choptank	32	X					
	Tuckahoe Creek	33				X		
Nanticoke/Wicomico	Lower Wicomico/Monie Bay/Wicomico Creek/Wicomico River Head	21/22/23/24	X					
	Nanticoke River	25		*	X			
	Marshyhope Creek	26					X	
	Fishing Bay/Transquaking River	27/28					X	
Pocomoke	Pocomoke Sound/Tangier Sound/Big Annemessex/Manokin River	13/18/19/20				X		
	Lower Pocomoke River	14			X			
	Upper Pocomoke River	15		X				3
	Dividing Creek/Nassawango Creek	16/17		X				
Ocean Coastal	Assawoman/Isle of Wight/Sinepuxent/Newport/Chincoteague Bays	8/9/10/11/12		X				
Other	Upper Chesapeake Bay/Middle Chesapeake Bay/Lower Chesapeake Bay/Atlantic Ocean	90/91/92/7						

(i.e., only 2 sites could be sampled in each of the 134 watersheds each year under that design, resulting in unreliable estimates at the 8-digit watershed scale). In addition, the costs of traveling to sample each watershed each year would be high, resulting in fewer than 210 sites being sampled annually. As an alternative to stratifying by watershed, the Survey designated the 84 watershed units of concern (both 55 single watershed units and 29 super-watersheds) as primary sampling units (PSUs). A subset of the 84 PSUs will be selected randomly each year, with restrictions to ensure that all 8-digit watersheds are sampled once during the five-year sampling period. Using this approach, a representative sub-set of watersheds can be studied each year, covering all the 84 watersheds of concern over a five-year period.

2.2.3.1 Lattice Sampling of Watersheds (PSUs)

Lattice sampling was used to schedule the sampling of all 84 watersheds (PSUs) over a 5-year period (see Cochran 1977; Jessen 1978). A sampling frame for selecting watersheds across time was formed by arranging the PSUs into a lattice with 84 rows and one column for each year (Table 2-1).

The 84 PSUs were stratified into five physiographic regions (strata) to ensure that their sampling is spread out geographically during each sample year (Figure 2-2). These five regions include whole major (Maryland 6-digit) drainage basins and divide the State into approximately equal parts. This stratification by region was done to spread out the sampling in space and thereby increase precision in statewide estimates; the geographic strata are not considered important reporting units.

A first-stage random sample of PSUs is drawn from each region in each year, with restrictions to ensure that all 84 watersheds (PSUs) of concern are sampled at least once during the 5-year sampling period. The lattice sampling supports an estimate of average statewide condition over the 5-year period. This strategy is similar to the lattice design used in the 1994 Demonstration Study (Vølstad et. al 1996) and the 1995-1997 MBSS Round One design (Roth et al. 1999); it takes into account the restrictions in annual sampling effort. About one-fifth of the watersheds in each of the five regions are randomly selected (without replacement) each year. In addition, two randomly selected watersheds in each region are being sampled twice during the five-year Survey (in randomly selected years). The representative sampling over time, augmented by repeated sampling of watersheds, ensures that all PSUs and pairs of PSU combinations have a known probability (greater than zero) of being selected. This probability-based sampling facilitates the estimation of statewide average condition over the 5-year study period with quantifiable precision based on the Horvitz-Thompson estimator (Horvitz and Thompson 1952; Thompson 1992). It also allows estimation of statewide conditions for each year of the Survey.

2.2.3.2 Stratified Random Sampling within PSUs

Within each PSU, the elementary sampling units from which field data are collected (i.e., the 75-m stream segments or sites) are selected using either stratified random sampling with proportional allocation, or simple random sampling (Cochran 1977). This allocation ensures that all sites in a PSU stream network have the same probability of being selected. The target sample size in each PSU is a minimum of 10 sites for the spring benthic sampling. Because of imperfections in the sample frame, a list of random replacement sites is provided for each PSU.

When the Round Two design was proposed, the target minimum of 10 sites per PSU was determined by analyzing the expected variability in IBI mean scores and percentage stream mile estimates as a function of varying sample size. Analysis (as presented in Southerland et al. 2000) indicated that fewer than 10 sites per PSU would not yield sufficient precision in stream mile estimates. Working with DNR, the survey designers determined that 10 sites per watershed would yield an acceptable level of precision while remaining within other design constraints (i.e., the annual level of effort available for sampling and the maximum sampling interval of five years for the statewide survey).

When feasible, the streams in each of the 55 PSUs consisting of a single 8-digit watershed were grouped into two strata based on stream order. One stratum includes all the first- and second-order streams, while the other includes all the third- and fourth-order streams. The number of sites in each of the two strata are allocated proportional to their stream length, resulting in equal sampling density for the two strata. In watersheds where the proportion of stream miles in one stratum (e.g., third- and fourth-order streams) is significantly below 10%, the stringent proportional allocation could not be achieved because it would result in allocation of less than one sample site to this stratum. Samples were not forced into strata that contained a minimal portion of stream miles, because this would eliminate the simplicity of equal probability sampling. Instead, the strata for such

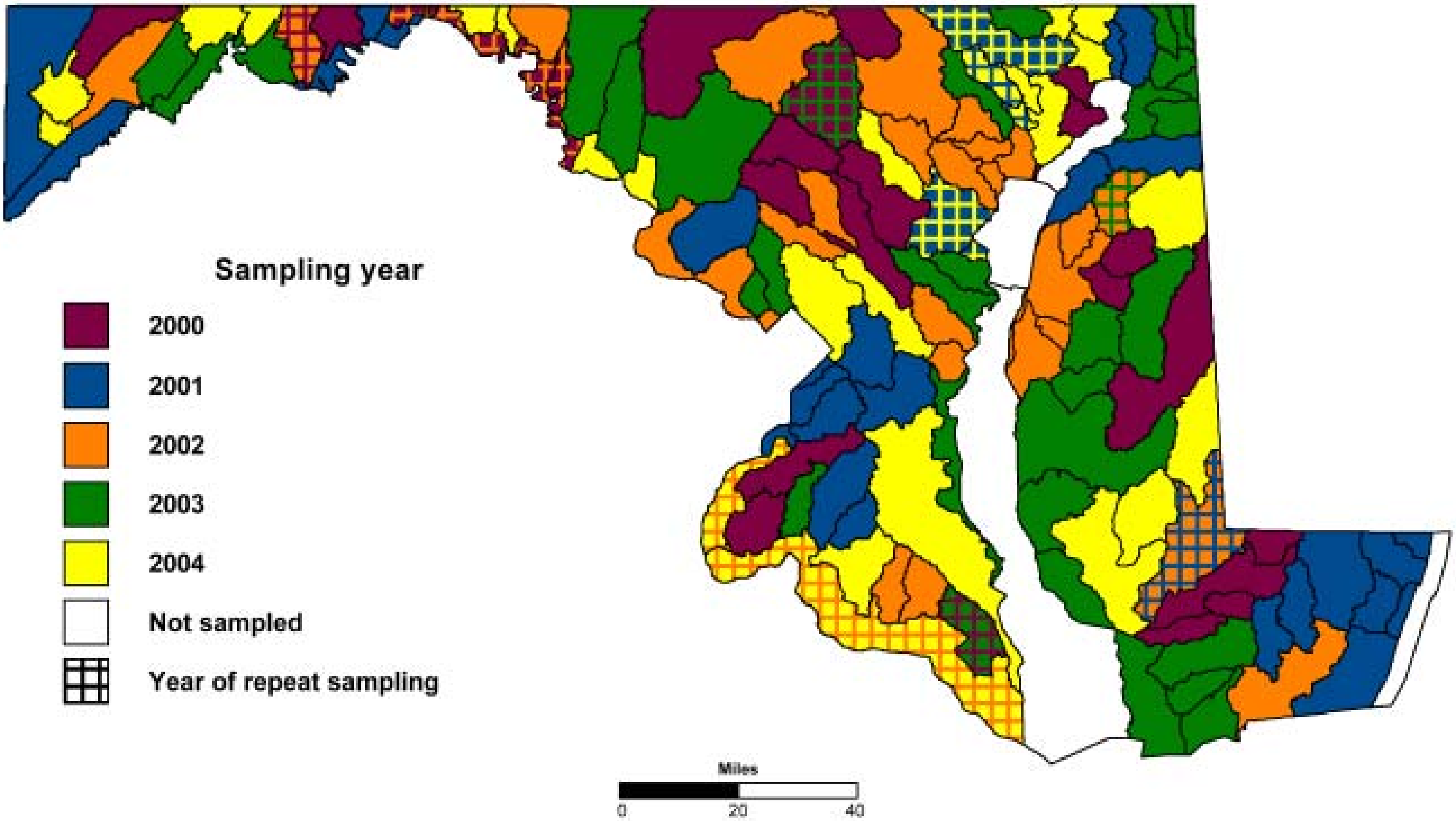


Figure 2-2. MBSS 2000-2004 Primary Sampling Units (PSUs) and sampling schedule

PSUs were collapsed, and a simple random sample of sites from all streams was selected.

A different stratification was used for the 29 PSUs consisting of more than one 8-digit watershed (i.e., the super-watersheds). For these PSUs, each constituent 8-digit watershed was designated a stratum, and the strata receive equal sampling fractions (i.e., proportional to stream miles in each 8-digit watershed). This stratification of super-watersheds was done to ensure that the non-tidal streams in each individual 8-digit watershed were sampled. While this approach may increase precision of stratified estimates for the super-watershed, the precision in estimates for individual 8-digit watersheds will generally be low because of low sample sizes. The limited sample sizes allocated to each PSU did not allow further stratification of the super-watersheds by stream order.

When one or more of the initial sample of stream segments in a PSU could not be sampled (e.g., dry stream or no permission to access), the stratification of the PSU was abandoned, and the replacement sites were selected from a list of simple random sites. This adjustment was made because the fraction of unsampleable sites cannot be adequately quantified for individual strata with low sample sizes.

2.2.3.3 Allocation of Additional Sites to Large Watersheds

Additional sites were allocated to 22 watersheds with more than 100 non-tidal stream miles. Increased sample sizes in these watersheds will reduce the variance of key estimates and improve statewide estimates (by more closely approximating statewide allocation proportional to stream miles). Over the five-year Survey, a total of 106 additional sites were allocated proportional to stream miles within these large watersheds (Table 2-2).

Table 2-2. List of MBSS Round Two Primary Sampling Units with greater than 100 non-tidal stream miles, scheduled for additional sample sites

Primary Sampling Unit	Number of Stream Miles	Number of Additional Sites
Lower Monocacy River	388.39	11
Upper Monocacy River	284.38	8
Patuxent River Lower	280.90	8
Loch Raven Reservoir	237.10	7
Conewago Creek/Double Pipe Creek	231.16	7
Youghiogheny River	222.56	6
Liberty Reservoir	184.08	5
Seneca Creek	178.85	5
Potomac River Lower North Branch	165.45	5
Potomac River MO Co	160.68	5
Anacostia River	159.34	5
Antietam Creek	146.34	4
Deer Creek	142.62	4
Patapsco River Lower North Branch	129.50	4
Catoctin Creek	128.95	4
Savage River	127.13	4
Upper Choptank	127.02	4
Little Patuxent River	122.48	3
Zekiah Swamp	120.75	3
Potomac WA Co/Marsh Run/Tonoloway/Little Tonoloway	118.43	3
Patuxent River Middle	111.19	3
Upper Pocomoke River	109.65	3

2.2.4 Site Selection

- Sample Frame Construction. The stream order of each reach was attributed on the 1:100,000-scale USGS Digital Line Graph (DLG) maps. If necessary, 1:24,000-scale USGS topographic maps were used as references to identify flow patterns or to see more detail. Where necessary, maps from Pennsylvania and Delaware were used to identify the stream order of water bodies originating outside of Maryland.

- Random Site Picks. Once the sample frame was developed for a PSU, sites were randomly assigned according to the stratified design described above using a FORTRAN-based program. If the proportion of stream miles in the smallest strata (either stream-order-based in single watershed PSUs or watershed-based in the super-watersheds) was greater than or equal to 10%, sites were allocated proportionally among strata; if it was less than 10%, the strata were collapsed and sites allocated by simple random sampling. After the target number of sites was selected (10 to 21 sites depending on PSU size), a simple random selection of "extra sites" to a total of 50 was chosen in each PSU using the GIS. This was done to ensure that a sufficient number of sites remained available for sampling after permission denials and unsampleable sites were removed from consideration.

  Each sample point chosen on the GIS was designated as the midpoint of the 75-m sampling segment in the field. Sites selected less than 75 meters from another randomly-selected site (both upstream and downstream) were eliminated. Sites that could possibly cross stream network nodes were not eliminated from the program; it was assumed that these sites could be adjusted in the field by moving the starting point away from the node, but staying within the designated stream order.

Each site was then attributed with the following information:

- stream order
- county
- basin
- physiographic region
- northing, easting
- latitude and longitude (both in decimal degrees and in degrees, minutes, seconds)
- watershed name and MD 8-digit watershed code.

2.2.5 Permissions from Landowners

- Extra Permissions. Permission was solicited to sample from landowners at twice the number of sites allocated to each PSU by the design (usually 20 sites, but from 26 to 42 in the larger watersheds). While the allocated number of sites (usually 10) were selected from the appropriate strata (see above), the "extra sites" were chosen to fill out the list, regardless of stream order. At the completion of site selection for each county, sites were sent to DNR for generation of 1:24,000-scale topographic maps and communication of sites to local governments planning stream monitoring.

- Landowner Identification. Each site was plotted on county tax maps using the Maryland Office of Planning Maryland Property View System obtained from DNR. From this, property owners could be identified, both for the site containing the point and for any areas required to access the stream. Phone numbers were obtained from the internet using a white pages directory (http://www.switchboard.com).

- Landowner Contact. If the phone number was unlisted, a letter was prepared requesting permission to access the property, including a written form and telephone contact information through which the landowner could respond. The letter also provided a MBSS brochure and telephone number to call for more information. If the number was listed, the property owner was called and permission to access the site was requested. After 2-3 calls and no success, a letter was sent. If the owner gave permission, the caller requested additional information about the site, such as whether the stream was often dry or hard to access. The caller also recorded whether the crew needed to make a pre-visit call to the landowner or whether the owner had to be available to open gates or walk the crew through the property. All property owner information was entered and maintained in a Microsoft Access database.

- Field Crew Information. Permission packets were then prepared for the field crews. Packets contained a printout of the property owner information for each site and a tax map showing possible access routes. The callers attempted to obtain permissions for the target sites in the proportions that stream orders occur in each PSU. In addition, permissions were obtained for extra sites (up to 50% more than the targeted number) to account for non-sampleable sites. These extra sites represent a simple random sample and may or may not be of the same stream order as the originally selected sites (for example, if a third- to fourth-order site was unsampleable, the replacement site was the next on the simple random list, regardless of stream order).

2.3 ANALYTICAL METHODS

2.3.1 Estimation of Means, Proportions and Totals Within Watersheds (PSUs)

2.3.1.1 Standard Estimators for the MBSS Sampling Program

The MBSS sampling design within watersheds (PSUs) involves simple random sampling, or stratified random sampling with proportional allocation of sites across the *L* strata. Standard PSUs have two strata based on stream order, while the strata in "super-watersheds" consist of the constituent 8-digit watersheds (Table 2-3).

Table 2-3. The following symbols refer to the population of streams and the sample of sites.

Population	Sample	Defined as
N_r	n_r	Number of watersheds (PSUs) in region *r*
M_{rih}	m_{rih}	Number of 75-m sites in stratum *h* within PSU *i* in region *r*. A standard PSU has two strata: (1) 1st - 2nd order streams; and (2) 3rd - 4th order streams. For super-watersheds, the number of strata is equal to the number of 8-digit watersheds within the PSU.
Y_{rihj}	y_{rihj}	Variable of interest associated with site j, j=1,2,...,m_{rih}

For simplicity the subscript *r* for region in the estimators for watersheds was not included. For PSUs with collapsed strata, estimates of means, totals, and proportions are based on the standard estimators for simple random sampling (Cochran 1977).

For PSUs where stratification could be achieved, stratified estimators were used. Suppose m_{ih} sites are chosen randomly in stratum *h*, within watershed *i*, and, at each site *j*, measurements are collected for the variable of interest y_{ihj}. Standard stratified estimators (Cochran 1977) are used to estimate means, proportions, and totals when all randomly selected sites in watershed *i* are sampleable, and the number of stream miles can be determined directly from the sample frame. An estimator for the mean of the variable of interest *y* is

$$\bar{y}_i = \sum_{h=1}^{L} w_h \bar{y}_h$$

where

$$\bar{y}_h = \frac{1}{m_{ih}} \sum_{j=1}^{m_{ih}} y_{ijk}$$

is the mean of *y* for watershed *i* within stratum *h* and w_h is the proportion of stream miles in the stratum (determined from the sample frame). The variance of the stratified mean for *y* in watershed *i* is

$$\mathrm{Var}\left(\bar{y}_i\right) = \sum_{h=1}^{L} w_{ih}^2 \frac{s_{ih}^2}{m_{ih}}$$

where

$$s_{ih}^2 = \frac{1}{m_{ih}} \sum_{j=1}^{m_{ih}} y_{ihj}$$

is the sample variance for the variable of interest in stratum *h* for watershed *i*. An estimator for the standard error of $\bar{y}_i$ is

$$\sqrt{\mathrm{Var}\left(\bar{y}_i\right)} \; .$$

The same estimators can be used to estimate proportions of stream miles in a specific class by introducing an indicator variable that takes the value 1 when the variable *y* meets the condition (e.g., pH < 6), and zero otherwise. The mean of this indicator using the estimators above is an estimate of the proportion of stream miles within the specific class (e.g., proportion of stream miles with pH < 6). When estimating proportions, the MBSS samples can be treated as repeated independent samples of binary observations (1 if pH < 6, and 0 otherwise) because the samples have equal inclusion probabilities. An exact confidence interval for an estimated proportion (p) is obtained from the binomial distribution (Collett 1999, pp. 23-24), with lower and upper confidence bounds

$$p_L = y[y + (n - y + 1)F_{2(n-y+1),2y}(\alpha / 2)]^{-1}$$

$$p_U = (y+1)[y+1+(n-y)F_{2(y+1),2(n-y)}(\alpha / 2)]^{-1}$$

respectively, where $F_{v1,v2}(\alpha/2)$ is the upper $(100\alpha/2)$ % point in the F-distribution with v_1 and v_2 degrees of freedom, and y is the observed number of successes (e.g., number of sites with IBI < 3) out of the n observations in a watershed.

An estimator for the total of a variable of interest (e.g., number of fish) in a watershed *i* is obtained by extrapolating the mean to all stream miles

$$\hat{Y}_i = M_i \bar{y}_i$$

with standard error

$$M_i \sqrt{Var(\bar{y}_i)} \ .$$

In practice some of the random sites m_{ih} selected in a watershed *i* may fall outside the defined target streams for MBSS. During periods of drought, for example, sections of streams represented on the 1:100,000-scale map used in MBSS may not exist. Also, because of imperfections in the sample frame, some selected sites may fall outside the actual network of target streams defined by MBSS. Loss of samples was anticipated in the MBSS, and a list of randomly selected replacement sites was provided for the sampling crews. For the MBSS, estimates are made for the target streams, which may be a subpopulation of streams within an imperfect sample frame. This subpopulation isreferred to as a *domain of study* (U.N. Subcommission on Sampling 1950).

For the MBSS, unsampleable streams are outside the domain of study. In this case, the Survey is interested in estimating parameters for the domain of study, i.e., for "MBSS target streams." All samples in watershed *i* can be treated as a simple random sample of size m_i , because samples were allocated to strata proportional to their stream length. This assumption is reasonable because the sampling fractions in the strata are equal, and each stream site has the same probability of being selected. Let the domain of study (MBSS target streams) in watershed *i* contain M'_{di} stream miles, and let m'_i be the number of sites of the simple random sample of size m_i that happens to fall in this domain. If y'_k (k=1,2,..., m'_i) are the measurements of the variable of interest from these sites, the mean for domain *d* is estimated by

$$\bar{y}_{id} = \sum_{k=1}^{m'_i} \frac{y'_k}{m'_i}$$

and an estimate for the standard error of $\bar{y}_{id}$ is

$$\frac{s_{id}}{\sqrt{m'_i}}$$

where

$$s_{id}^2 = \sum_{k=1}^{m'_i} \frac{(y'_k - \bar{y}_{id})^2}{m'_i - 1}$$

The finite population correction factor can safely be ignored because the sampling fraction (i.e., the number of 75-m segments sampled relative to all available) within each watershed is small.

2.3.1.2 Estimators for Combining MBSS with Additional Probability-based Sampling Programs

When additional MBSS compatible data for a watershed are available from a probability-based sampling program, it is possible to combine the data by using a composite estimator (Vølstad et al. 2002). Assume that MBSS and a County program provide simultaneous estimates of the mean IBI for a watershed, and that the total length of streams covered by each survey j is L_j . The combined mean IBI for the watershed can then be estimated by a linear combination of the individual survey weighted means (Korn and Graubard 1999) $\overline{y}_1$ and $\overline{y}_2$,

$$\overline{y} = \frac{(k_1 L_1)\,\overline{y}_1 + (k_2 L_2)\,\overline{y}_2}{k_1 L_1 + k_2 L_2}$$

If $\overline{y}_1$ and $\overline{y}_2$ are approximately unbiased for the population mean IBI, then $\overline{y}$ will also be unbiased. The variance of $\overline{y}$ is minimized by using the weights

$$k_j = \frac{L_1 + L_2}{2L_j}\left(1 - \frac{Var(\overline{y}_j)}{Var(\overline{y}_1) + Var(\overline{y}_2)}\right) \quad ,$$

which grant more influence to precise estimates and greater survey coverage.

To estimate the variance of the combined mean $\overline{y}$ assume that each survey j has S_j number of strata; j = 1,2. The population of stream segments in the watershed is treated as if it was composed of $S = S_1 + S_2$ strata. This stratification controls for survey differences (Korn and Graubard 1999). When the two surveys are independent,

$$Var(\overline{y}) = \sum_{i=1}^{S} w_i^2 Var(\overline{y}_i)$$

where the strata weights

$$w_i = \frac{L_i}{\sum_{i=1}^{S} L_i}$$

are the fractions of the total stream length (for both surveys) in each stratum. An estimator for the standard error of $\overline{y}$ is

$$\sqrt{Var(\overline{y})}\ .$$

The same estimators can be used to estimate proportions of stream miles in a specific class by introducing an indicator variable that takes the value 1 when the variable y meets the condition (e.g., pH < 6), and zero otherwise. The mean of this indicator using the estimators above is an estimate of the proportion of stream miles within the specific class (e.g., proportion of stream miles with pH < 6). The estimation of exact confidence intervals for pooled data based on the binomial distribution (section 2.3.1.1) is valid only if the County program also employs simple random or an equivalent sampling design .

2.3.1.3 Estimators for Combining MBSS Data Across Sampling Rounds

While IBI data from the two rounds (e.g., 1996 and 2000 data) cannot simply be pooled because of the different study designs, the mean IBIs from the two rounds can be combined. In a watershed where there are sufficient samples in each round to calculate a mean and standard error, the estimates for each round can be combined into a single estimate using composite estimation (Korn and Graubard 1999). It is recommended that the combined estimate only be applied when the combined data represent an effective sample size of at least 10 samples. For MBSS Round One, a minimum of two samples per stratum are required (i.e., two samples in each of stream orders 1, 2, and 3).

Assume that two rounds provide estimates for the same population of streams, as defined on the 100,000 scale map, and that the two surveys were independent. Under this assumption temporal differences in the actual stream network caused by variation in rainfall or other factors are not taken into account. Let $\overline{x}_1$ and $\overline{x}_2$ be the mean IBIs for two rounds, with respective standard errors SE_1 and SE_2 calculated according to the respective survey design. Equal weights are assigned to each year's estimate, and use the simple combined estimator

$$\overline{x} = \frac{\overline{x}_1 + \overline{x}_2}{2}$$

for the pooled mean IBI, with variance

$$\mathrm{var}(\overline{x}) = \frac{1}{4}\left\{\mathrm{var}(\overline{x}_1) + \mathrm{var}(\overline{x}_2)\right\}$$

and standard error

$$SE = \frac{1}{2}\sqrt{SE_1^2 + SE_2^2}$$

This simple approach was applied to avoid that the combined mean would be driven by the estimate for one particular year. When more than one survey is conducted in a watershed during the same year it is recommended that the means be weighted based on sample sizes or their variances (Korn and Graubard 1999). When significant differences occur between the sampling frames for two surveys in a watershed because of differences in maps scale (1:24,000 verus 100,000, for example), and their variances this should also be accounted for by adjusting the weights (Korn and Graubard 1999; Vølstad et al. 2002).

The difference in map scale between the two MBSS sampling rounds (1:250,000 versus 1:100,000) is likely to have only a small effect on the mean IBI scores because the network of streams on the two maps approximately overlaps. The 1:100,000 map includes a certain number of small headwater streams that are not included on the 1:250,000 map. However, the MBSS IBI scoring is only applied to streams in catchments over 300 acres, and thus it is reasonable to assume that the target population of streams are the same across rounds.

2.3.1.4 Testing for Differences in Mean IBI Scores Between Years

Comparisons of statistical differences between mean IBI scores from two years were conducted using the standard method recommended by Schenker and Gentleman (2001). This test was used because it is more robust than the commonly used method of examining the overlap between the two associated confidence intervals. Assume that $\hat{Q}_1$ and $\hat{Q}_2$ are two independent estimates of mean IBI, and that the associated standard errors (*SE*) are estimated by $\hat{S}E_1$ and $\hat{S}E_2$. We estimated the 95% confidence interval for $\hat{Q}_1$ - $\hat{Q}_2$ by

$$(\hat{Q}_1 - \hat{Q}_2) \pm 1.96 \left[\hat{S}E_1^2 + \hat{S}E_2^2 \right]^{1/2}$$

and tested (at 5% nominal level) the null hypothesis that $\hat{Q}_1 - \hat{Q}_2$ = 0 by examining whether the 95% confidence interval contains 0. The null hypothesis that two estimates are equal was rejected if and only if the interval did not contain 0 (Schenker and Gentleman 2001).

2.4 LANDOWNER PERMISSION RESULTS

As discussed in Section 2.2.5, permissions were obtained to access privately owned land adjacent to or near each stream segment. For 2001, the overall success rate for obtaining permissions was 68% (Table 2-4). Cases where permissions were not obtained included both denials (9%) as well as non-responses (23%), when landowners were unable to be reached and did not respond to letters and telephone messages. The success rate was 91% for landowners who responded to phone or letter permission requests. Reasons for permission denial varied widely and generally reflected the preferences of individual landowners regarding property access, rather than any specific types of land. In rare cases, permission denial may affect the interpretation of MBSS estimates, but only where denials occur in streams with characteristics that differ from the general population of streams. During 2001 sampling, it did not appear that permission denials affected MBSS estimates.

2.5 NUMBER OF SITES SAMPLED IN 2001

As stated in Section 2.2.3.2 above, the target sample size in each PSU is a minimum of 10 sites for the spring benthic sampling. Additional sites were allocated to the larger PSUs sampled in 2001: Youghiogeny River (6 extra), Seneca Creek (5 extra), Deer Creek (4 extra), Zekiah Swamp (3 extra), Patuxent River Middle (3 extra), Upper Pocomoke River (3 extra). Table 2-5 lists the number of sites sampled for spring benthic, physical habitat, and water chemistry sampling. For most nearly all PSUs, the number of sites actually sampled equaled or exceeded the target number specified in the design. Ten sites were unsampleable in the spring for a variety of reasons, including dry stream beds and impoundments. Note that in both Assawoman/Isle of Wight/Sinepuxent/Newport/ Chincoteague Bays and Sassafras River/Stillpond-Fairlee, only nine sites were sampled instead of the targeted ten. This was due to an abundance of dry streams in each of the watersheds and/or lower than anticipated landowner permission rates in those PSUs.

During summer sampling, a small number of sites that had been sampled in the spring were unsampleable for several reasons, the most common being that the stream had dried up. Table 2-6 lists the number of sites that were electrofished during the summer of 2001. It also lists the number of sites where summer habitat and water quality measures were taken, as well as the number of sites where amphibians and reptiles, mussels, and aquatic vegetation were qualitatively sampled.

Table 2-4. Landowner permission success rates for Primary Sampling Units (PSUs) sampled in the 2001 MBSS

PSU	Number of Stream Segments Targeted as Potential Sample Sites	Success Rate	No Response	Denial Rate
Youghiogheny River	32	60%	15%	25%
Potomac River Upper North Branch	20	90%	5%	5%
Potomac AL Co/Sideling Hill Creek	20	90%	5%	5%
Seneca Creek	30	63%	27%	10%
Piscataway Creek	20	75%	20%	5%
Potomac Upper Tidal/Oxon Creek	20	65%	30%	5%
Zekiah Swamp	26	69%	31%	0%
Gilbert Swamp	20	70%	20%	10%
Assawoman/Isle of Wight /Sinepuxent/ Newport /Chincoteague Bays	20	45%	35%	20%
Western Branch	20	60%	40%	0%
Patuxent River Middle	26	58%	27%	15%
Bodkin Creek/Baltimore Harbor	20	90%	10%	0%
Little Gunpowder Falls	20	65%	30%	5%
Sasssafras River/Stillpond-Fairlee	20	75%	15%	10%
Northeast River/Furnace Bay	20	55%	35%	10%
Nanticoke River	20	70%	15%	15%
Dividing Creek/Nassawango Creek	20	60%	35%	5%
Upper Pocomoke River	26	69%	19%	12%
Deer Creek	28	75%	14%	11%
TOTAL	428	68%	23%	9%

2.6 FIELD AND LABORATORY METHODS

2.6.1 Spring and Summer Index Periods

Benthic macroinvertebrate and water quality sampling were conducted in spring, when acidic deposition effects are often the most pronounced. While it is recognized that several different index periods may be used for benthic sampling, the MBSS chose the spring index period for logistical purposes. Fish, amphibian, reptile, and aquatic vegetation surveys, along with physical habitat evaluations, were conducted during the low-flow period in summer. Fish community composition tends to be stable during summer, and low flow is advantageous for electrofishing. Because low-flow conditions in summer may be a primary factor limiting the abundance and distribution of fish populations, habitat assessments were performed during the summer.

To reduce temporal variability, sampling was conducted within specific, relatively narrow time intervals, referred to as index periods. The spring index period was defined by degree-day limits for specific parts of the state. The spring index period was between March 1 and about May 1, with the end of the index period determined by degree-day accumulation as specified in Hilsenhoff (1987). In 2001, all spring samples were collected in March, well before degree-day accumulation limits were approached. The targeted summer index period was between June 1 and September 30 (Kazyak 2001). In 2001, all summer sampling was completed by the end of August, well before the end of the targeted index period. While the spring index period is two months in duration because of changing weather conditions (possible rapid warming leading to changes in stream condition), the summer index period is four months long because weather conditions are more consistent throughout the season and fish sampling is more time consuming.

Table 2-5. Number of sites sampleable in the spring for MBSS 2001 PSUs				
PSU	**Number of Unsampleable Sites**	**Number of Benthic Sites**	**Number of Spring Habitat Sites**	**Number of Spring Water Quality Sites**
Youghiogheny River	0	16	16	16
Potomac River Upper North Branch	0	10	10	10
Potomac AL Co/Sideling Hill Creek	0	10	10	10
Seneca Creek	0	15	15	15
Piscataway Creek	0	10	10	10
Potomac Upper Tidal/Oxon Creek	0	10	10	10
Zekiah Swamp	0	13	13	13
Gilbert Swamp	0	10	10	10
Assawoman/Isle of Wight/Sinepuxent/ Newport/Chincoteague Bays	0	9	9	9
Western Branch	0	10	10	10
Patuxent River Middle	0	13	13	13
Bodkin Creek/Baltimore Harbor	3	10	10	10
Little Gunpowder Falls	0	10	10	10
Sasssafras River/Stillpond-Fairlee	6	9	9	9
Northeast River/Furnace Bay	0	10	10	10
Nanticoke River	0	10	10	10
Dividing Creek/Nassawango Creek	0	10	10	10
Upper Pocomoke River	0	13	13	13
Deer Creek	0	14	14	14
TOTAL	9	212	212	212

Table 2-6. Number of sites sampleable in the summer for MBSS 2001 PSUs						
PSU	**Number of Sites Fished**	**Number of Summer Habitat Sites**	**Number of Summer Water Quality Sites**	**Number of Sites - Amphibians and Reptiles**	**Number of Sites - Mussels**	**Numb er of Sites - SAV**
Youghiogheny River	16	16	16	16	16	16
Potomac River Upper North	10	10	10	10	10	10
Potomac AL Co/Sideling Hill	6	6	6	9	6	6
Seneca Creek	14	14	14	14	14	14
Piscataway Creek	10	10	10	10	10	10
Potomac Upper Tidal/Oxon Creek	10	10	10	10	10	10
Zekiah Swamp	13	13	13	13	13	13
Gilbert Swamp	10	10	10	10	10	10
Assawoman/IsleofWight/Sinepux	7	7	7	9	7	7
Western Branch	9	9	9	9	9	9
Patuxent River Middle	13	13	13	13	13	13
Bodkin Creek/Baltimore Harbor	10	10	10	10	10	10
Little Gunpowder Falls	10	10	10	10	10	10
Sasssafras River/Stillpond-Fairlee	9	9	9	9	9	9
Northeast River/Furnace Bay	9	9	9	9	9	9
Nanticoke River	8	9	9	9	9	9
Dividing Creek/Nassawango Creek	9	9	9	10	9	9
Upper Pocomoke River	12	12	12	13	12	12
Deer Creek	14	14	14	14	14	14
TOTAL	199	200	200	207	200	200

2.6.2 Water Chemistry

During the spring index period, water samples were collected at each site for analysis of water quality conditions, with an emphasis on factors related to acidic deposition and nutrients (Table 2-7). Grab samples were collected in 0.5 and 1-liter bottles for analysis of all analytes except pH. Water samples for pH were collected with 60 ml syringes, which allowed purging of air bubbles to minimize changes in carbon dioxide content (EPA 1987). Samples were stored on wet ice and shipped on wet ice to the analytical laboratory within 48 hours. The requirement to filter for some analytes within 48 hours was exceeded by several hours for some samples. Laboratory analyses were carried out by the University of Maryland's Appalachian Laboratory in Frostburg.

Chemical analysis of water samples followed standard methods as listed in Table 2-7. Routine daily quality control (QC) checks included processing duplicate, blank, and calibration samples according to EPA guidelines for each analyte. Field duplicates were taken at 5% of all sites. Routine QC checks helped to identify and correct errors in sampling routines or instrumentation at the earliest possible stage. Standard operating procedures were implemented that detail the requirements for the correct performance of analytical procedures. The internal QA/QC protocols followed guidelines outlined in EPA (1987). The complete QA/QC report for 2001 MBSS laboratory analysis can be found in Kline and Morgan (2001). QC results were examined in conjunction with site data and are summarized in a separate report (Mercurio et al. 2002).

During the summer index period, in situ measurements of dissolved oxygen (DO), pH, temperature, and conductivity were collected at each site to further characterize existing water quality conditions that might influence biological communities. Measurements were made at an undisturbed section of the segment, usually in the middle of the stream channel and at the upstream segment boundary, using electrode probes. Instruments were calibrated daily and calibration logbooks were maintained to document instrument performance. In 2001, there were no quality assurance problems apparent in log books and other documentation (Mercurio et al. 2002).

2.6.3 Benthic Macroinvertebrates

Benthic macroinvertebrates were collected to provide a semi-quantitative description of the community composition at each sampling site. Sampling was conducted during the spring index period. Benthic community data were collected primarily for the purpose of calculating DNR's Benthic Index of Biotic Integrity (BIBI) for Maryland streams (Stribling et al. 1998). Recognizing that Maryland streams vary from high-gradient riffle habitat with abundant cobble substrate to low-gradient Coastal Plain streams with sandy or silty bottoms, MBSS employs a "D" net suitable for sampling a wide variety of habitats. This multi-habitat approach is consistent with the recommendations of the Mid-Atlantic Coastal Streams Workgroup (MACS 1996) and the EPA's most recent Rapid Bioassessment Protocols (Barbour et al. 1999).

At each segment, a 600-micron mesh "D" net was used to collect organisms from habitats likely to support the greatest taxonomic diversity. This habitat often includes a riffle area when present. Other habitats, in order of preference, include gravel, broken peat, or clay lumps in a run area; snags or logs that create a partial dam or are in run habitat; undercut banks and associated root mats; and SAV and detrital/sand areas in moving water. In riffles and most other habitats, sampling involved placing the net downstream, gently rubbing surficial substrates by hand to dislodge organisms, and disrupting deeper substrates using vigorous foot action. Each dip of the net covered one-two square feet, and a total of approximately 2.0 m^2 (20 square feet) of combined substrates was sampled; samples were preserved in 70% ethanol. Duplicate benthic samples were taken at 19 MBSS sites to assess the replicability of the field methods.

In the laboratory, the preserved sample was transferred to a gridded pan and organisms were picked from randomly selected grid cells until the cell that contained the 100th individual (if possible) was completely picked. Some samples had fewer than 100 individuals. The benthic macroinvertebrates were identified to genus, or lowest practicable taxon, in the laboratory. To aid in identification, oligochaete and chironomid taxa were slide-mounted and identified under a microscope. Laboratory QC procedures included the re-subsampling and identification of every 20th sample. This second sample was identified according to standard procedures and comparisons were made between the two duplicates. For the 2001 sampling year, samples from 13 sites were re-subsampled for QC purposes. The MBSS voucher specimen collection is currently maintained at the Maryland DNR Field Office in Annapolis, Maryland. A complete description of laboratory protocols can be found in Boward and Friedman (2000) and results of the QC analysis can be found in Mercurio et al. (2002).

In macroinvertebrate monitoring, the decision to employ a particular subsample size (100 vs. 200 or greater) reflects a balance of how to best utilize program effort. While a

Analyte (units)	Method	Instrument	Detection Limit	Holding Time (days)
pH (standard units)	EPA (1987) Method 19	Orion pH meter	0.01	7
Acid neutralizing capacity (μeq/l)	EPA (1987) Method 5	Brinkmann Automated Titration System equipped with customized software	0.01	14
Sulfate (mg/l)*	EPA (1987) Method 11	Dionex DX-500 Ion Chromatograph (AS-9 HC column)	0.03	14
Nitrite nitrogen* (mg/l)	EPA (1999) Method 354.1	Lachat QuikChem Automated Flow Injection Analysis System	0.0005	28 (frozen)
Nitrate nitrogen* (mg/l)	EPA (1987) Method 11	Dionex DX-500 Ion Chromatograph (AS-9 HC column)	0.01	14
Ammonia (mg/l)*	EPA (1999) Method 350.1	Lachat QuikChem Automated Flow Injection Analysis System	0.003	28 (frozen)
Total nitrogen (mg/l)*	APHA (1998) 4500-N (B)	Lachat QuikChem Automated Flow Injection Analysis System w/In-line Digestion Module	0.050	28 (frozen)
Orthophosphate (mg/l)*	APHA (1998) 4500-P (G)	Lachat QuikChem Automated Flow Injection Analysis System	0.0010	28 (frozen)
Total phosphorus (mg/l)*	APHA (1998) 4500-P (I)	Lachat QuikChem Automated Flow Injection Analysis System w/In-line Digestion Module	0.0013	28 (frozen)
Chloride (mg/l)*	EPA (1987) Method 11	Dionex DX-500 Ion Chromatograph (AS-9 HC column)	0.02	14
Specific conductance (μmho/cm)	EPA (1987) Method 23	YSI Conductance Meter w/Cell	0.1	7
Dissolved organic carbon (mg/l)*	EPA (1987) Method 14	Dohrmann Phoenix 8000 Organic Carbon Analyzer	0.14	28
Particulate carbon (mg/l)	D'Elia et al. (1997)	CE Elantech N/C Analyzer	0.0595	

Table 2-7. Analytical methods used for water chemistry samples collected during the spring index period.

* Indicates analyses that require filtration within 48 hours

larger subsample may improve precision in characterizing individual sites, each sample then requires additional effort for laboratory identification. If a program goal is better precision in characterizing watersheds, the added effort might be spent on a sampling more sites per watershed. At the outset of the MBSS monitoring program, a decision was made that 100-organism subsamples would provide acceptable precision at the single site level, and that, within a given total cost, effort would instead be focused on maximizing the total number of sites that could be sampled. However, DNR is interested in further investigating the effect of 100- vs. 200-organism subsampling. In a related study currently underway with Montgomery County Department of Environmental Protection (with EPA sponsorship), the effects of 100 vs. 200 organism subsampling are being evaluated, including optimization analysis to assess the tradeoffs between subsample size and total number of sites, given a fixed total cost for a monitoring program.

2.6.4 Fish

Fish were sampled during the summer index period using double-pass electrofishing within 75-meter stream segments. Block nets were placed at each end of the segment and direct current backpack electrofishing units were used to sample the entire segment. An attempt was made to thoroughly fish each segment on each pass, sampling all habitat within the entire stream segment. A consistent effort was applied over the two passes. This sampling approach allowed calculation of several metrics constituting the biological index and produced estimates of fish species abundance.

In small streams, a single electrofishing unit was used. In larger streams, two or more were employed to effectively sample the site. Captured fish from each pass were identified to species, weighed in aggregate, counted, and released. Any individuals that could not be identified to species were retained for laboratory confirmation, and a voucher series of about 10 individuals was retained for each major (Maryland 6-digit) drainage basin. For each pass, all individuals of each gamefish species (defined as trout, bass, walleye, northern pike, chain pickerel, and striped bass) were measured for total length. For each species, unusual occurrences of visible external pathologies or anomalies were noted.

All voucher specimens and fish retained for positive identification in the laboratory were examined and verified by Dr. Rich Raesley, an ichthyologist at Frostburg State University, Frostburg, Maryland. All MBSS collections are archived in the fish museum at Frostburg State University.

2.6.5 Amphibians and Reptiles

At each segment sampled during the summer, amphibians and reptiles found during the course of electrofishing and other activities were captured, identified, and recorded. Individuals were identified to species when possible, but larval salamanders and tadpoles were not retained. Voucher specimens and individuals not positively identifiable in the field were retained for examination in the laboratory.

2.6.6 Mussels

During the summer index period, freshwater mussels were sampled by visual inspection at each 75-meter stream segment. The presence of Unionid mussels or Asiastic clam (*Corbicula fluminea*) was recorded as live, old shell, or recent shell.

2.6.7 Aquatic and Streamside Vegetation

During the summer index period, aquatic vegetation was sampled qualitatively by examining each 75-meter stream segment for the presence of aquatic plants. The presence and relative abundance of submerged, emergent, and floating aquatic vegetation were recorded.

In addition, the presence and relative abundance of invasive terrestrial plant species (e.g., multiflora rose) were recorded during summer sampling.

2.6.8 Physical Habitat

Habitat assessments were conducted during summer sampling at all stream segments as a means of assessing the importance of physical habitat to the biological integrity and fishability of freshwater streams in Maryland. Procedures for habitat assessment (Kazyak 2001) were derived from two commonly used methodologies: EPA's Rapid Bioassessment Protocols (RBPs) (Plafkin et al. 1989), as modified by Barbour and Stribling (1991), and the Ohio EPA's Qualitative Habitat Evaluation Index (QHEI) (Ohio EPA 1987, Rankin 1989).

During spring, riparian zone vegetation type and width on each bank was estimated to the nearest meter (up to 50 meters from stream). Severity and type of buffer breaks were noted. Local land use type and the extent and type of stream channelization were recorded and stream gradient was measured. Crews also recorded distance from road and assigned a trash rating (based on visible signs of human refuse at a site) to characterize human presence.

During summer sampling, several habitat characteristics (instream habitat, epifaunal substrate, velocity/depth diversity, pool/glide/eddy quality, and riffle/run quality) were assessed qualitatively on a 0-20 scale, based on visual observations within each segment. The percentage of embededdness of the stream channel and the percentage of shading of the stream site were estimated. Also recorded were the extent and severity of bank erosion and bar formation, number of woody debris and rootwads within the stream channel, and the presence of various stream features such as substrate types, various morphological characteristics, and beaver ponds. Maximum depth within the segment was measured. Wetted width, thalweg depth, and thalweg velocity were recorded at four transects. A complete velocity/depth profile was taken at one transect to compute discharge (streamflow); for sites with extremely low flow, the speed of a floating object was substituted to allow calculation of discharge.

Recognizing that water temperature is an important factor affecting stream condition (but one that varies daily and seasonally), the Survey deployed temperature loggers at most sites. A single Onset Computer Corporation Optic Stowaway model temperature logger was anchored in each sample site during the summer index period. They recorded the water temperature every 20 minutes from approximately June 1 until September 1. Field crews had the option of retrieving the loggers during summer sampling if the site was visited after August 15. In some cases, the same logger was used for two sites if they were close together on the same reach. Also, if a site was nearly dry in the spring, field crews may have elected not to deploy a logger.

2.7 QUALITY ASSURANCE

Quality assurance and quality control (QA/QC) are integral parts of the data collection and management activities of the Survey. The Survey employs well-established QA/QC procedures, as detailed in Kazyak (2001). Some key points are highlighted below.

2.7.1 Data Management

All crews used standardized pre-printed data forms developed for the Survey to ensure that all data for each sampling segment were recorded and standard units of measure were used. Using standard data forms facilitates data entry and minimizes transcription error. The field crew leader and a second reviewer checked all data sheets for completeness and legibility before leaving each sampling location. Original data sheets were sent to the Data Management Officer for further review, another signoff, and data entry, while copies were retained by the field crews.

A custom database application (written in Microsoft Access), in which the input module was designed to match each of the field data sheets, was used for data entry. Data were independently entered into two databases and compared using a computer program as a quality-control procedure. Differences between the two databases were resolved from original data sheets or through discussions with field crew leaders.

2.7.2 QA/QC for Field Sampling

A Quality Control Officer (QC Officer) experienced in all aspects of the Survey was appointed to administer the quality assurance program. Specific quality assurance activities administered by the QC Officer included preparing a field manual of standard sampling protocols, designing standard forms for recording field data, conducting field crew training and proficiency examinations, conducting field and laboratory audits, making independent habitat assessments, identifying taxa, reviewing all reports, and reporting errors.

To ensure consistent implementation of sampling procedures and a high level of technical competency, experienced field biologists were assigned to each crew and all field personnel completed program training before participating in field sampling. Training topics included MBSS program orientation, stream segment location using global positioning system (GPS) equipment, sampling protocols, operation and maintenance of sampling equipment, data transcription, quality assurance/quality control, and safety. The spring field crews received additional training in sampling protocols for water quality and benthic macroinvertebrates. The summer field crews received additional training in habitat assessment methods, taxonomy, and *in situ* water chemistry assessment.

Training included classroom, laboratory, and field activities. Instructors emphasized the objectives of the Survey and the importance of strict adherence to the sampling protocols. The QC Officer conducted proficiency examinations to evaluate the effectiveness of the training program and ensure that the participants had detailed knowledge of the sampling protocols. Members of the spring sampling crew were required to demonstrate proficiency in techniques for collecting samples for water chemistry and benthic macroinvertebrates. At least one member of each summer sampling crew was required to pass a comprehensive fish taxonomy examination. Each crew also demonstrated proficiency in locating pre-selected stream segments using the GPS receiver and determining if the segment was acceptable for sampling. Comprehensive "dry runs" were conducted to simulate actual field conditions and evaluate classroom instruction.

Field audits were conducted by the QC Officer during the field sampling to assess the adequacy of training, adherence to sampling protocols, and accuracy of data transcription. The audits included evaluation of the preparation and planning prior to field sampling, stream segment location using GPS equipment and assessment of acceptability for sampling, adherence to sampling protocols, data transcription, and equipment maintenance and calibration. The QC Officer made an independent assessment of habitat at all segments where field audits were done (approximately 7.5% of the total number of sites).

A separate QA report (Mercurio et al. 2002) reports on details of QA activities for the 2001 sampling year.

2.8 CLIMATIC CONDITIONS

Because all flow in Maryland streams ultimately arises from precipitation, weather is an important factor in stream condition. In Maryland, annual precipitation varies geographically, averaging between 40 and 50 inches. In the western half of the state, the prevailing winds are from the west, typically mixing moisture from the south with colder temperatures from the north. Because of these prevailing winds and Maryland’s mountain ridges (which create a rainshadow effect), rain and snowfall are greater in the west and precipitation tends to be heavier on west-facing slopes. In the eastern half of the state, prevailing winds are also westerly, but many storm events are also influenced by moisture from the coast and precipitation patterns there reflect that influence. These precipitation patterns have an obvious effect on runoff, a primary factor in determining stream characteristics. Because the flow of water (stream discharge) is one of the critical determinants of stream habitat quantity and quality, drier portions of the state should have less aquatic habitat than areas that are wetter.

Temporal changes in the amount of precipitation are also important in determining the amount of habitat available to aquatic organisms. Figures 2-3 through 2-5 show the monthly deviation from normal precipitation (in inches) for the years 1998-2000 (NOAA 1998, NOAA 1999, and

NOAA 2001). This number is the average of the deviation from normal precipitation (calculated using 100 years of precipitation data) in eight regions of the state, so it is possible that some effects seen only in the eastern portion of the state may be masked by events in the western portion of the state and vice versa. Actual monthly values for each region are shown in Appendix A.

In 1998, the first six months of the year were wetter than normal, with January, the wettest month, averaging 2.88 inches of precipitation wetter than normal. The last six months of 1998 were drier than normal, with November averaging 2.45 inches of precipitation less than normal. Total precipitation for 1998 was 1.66 inches above normal. The spring and summer of 1999 experienced drought conditions (especially noticed in the eastern portions of the state) with the average precipitation in April through July experiencing between 2.44 and 1.64 inches less precipitation than normal. In September, Hurricane Floyd hit most of central and eastern Maryland, causing average precipitation to jump to almost 7 inches above normal. During this month, some streams, including Gwynns Falls in Baltimore, exceeded the flood of record. By October, precipitation had stabilized to normal, and in November and December, the state was experiencing less than normal amounts of precipitation. Total precipitation for 1999 was 0.58 inches below normal, showing that the extended drought had more of influence on precipitation patterns than the hurricane. Spring and summer months of 2000 experienced greater than normal amounts of precipitation (with the exception of May), while fall and winter months experienced less precipitation than normal. While the spring and summer months (with the exception of April) of 2001 received greater than normal amounts of precipitation the fall and winter months' precipitation amounts were drastically below normal. This circumstance lead to a deficit of almost 6 inches of rain for the year 2001, the beginning of a drought condition.

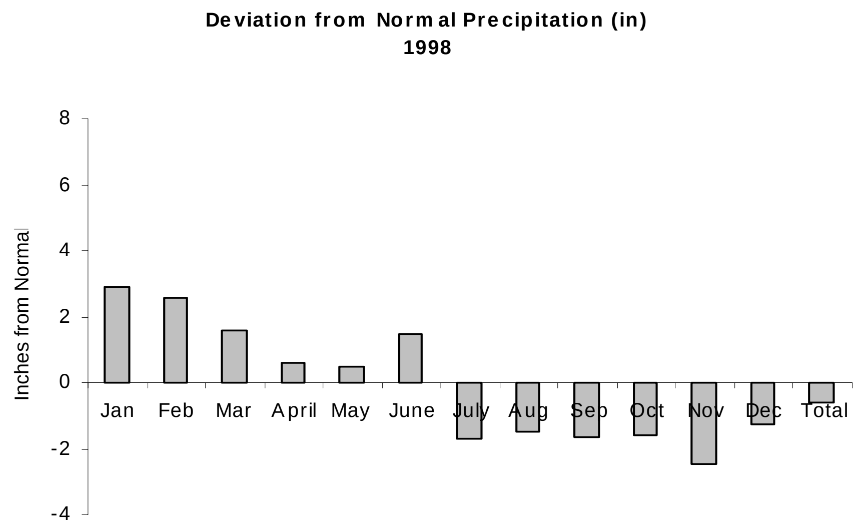


Figure 2-3. Statewide average deviation from normal precipitation during 1998

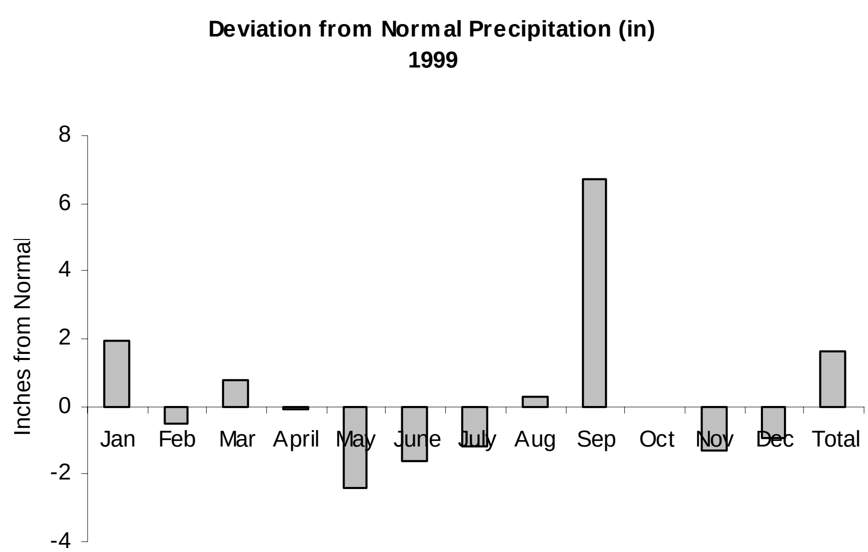


Figure 2-4. Statewide average deviation from normal precipitation during 1999

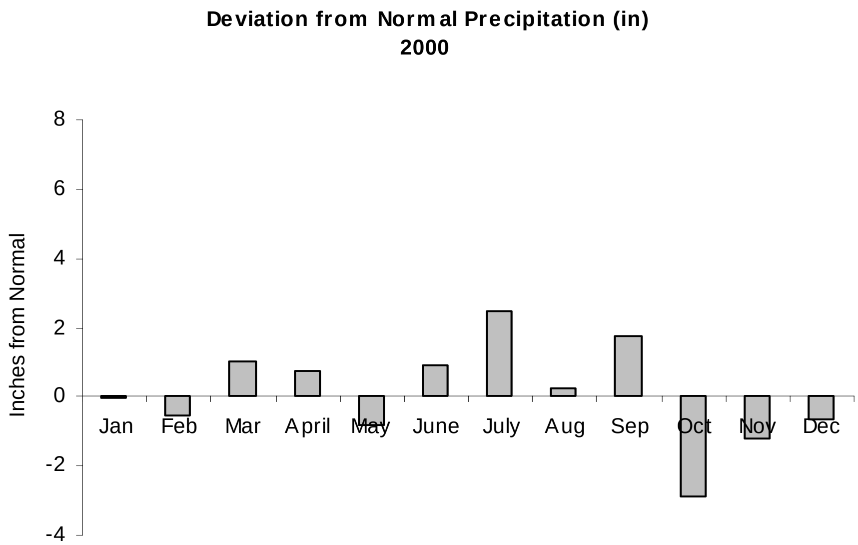


Figure 2-5. Statewide average deviation from normal precipitation during 2000

3 THE STATE OF THE STREAMS: COMPARATIVE ASSESSMENT OF WATERSHEDS SAMPLED IN 2001

This chapter provides a comparative assessment of the watersheds sampled by the MBSS (or Survey) in 2001. Separate sections focus on biodiversity, biological indicator results, and three predominant issues affecting biological resources: acidification, physical habitat, and nutrients and other water chemistry. The indicators used were developed during Round One of the MBSS and have been deemed reliable for representing ecological condition by field verification and expert peer review. Nonetheless, the MBSS continues to pursue refinements to its indicators including improvements to the provisional physical habitat index (PHI), methods for combining indicators that do not lose information (e.g., combined biotic index), and changes to the indicator thresholds and scoring methods to make them more intuitive and accessible to the public.

3.1 BIODIVERSITY

In addition to assessing the integrity of streams and watersheds, the Survey provides invaluable information on the abundance and distribution of rare species. Documenting the presence (and ultimately abundance in the five-year Round Two report) of rare species, the Survey supports a more thorough characterization of Maryland's biodiversity. During MBSS sampling in 2001, a substantial number of rare or unusual occurrences of fish were documented. This chapter presents a brief summary of particularly noteworthy findings. One state-listed endangered species, glassy darter (*Etheostoma vitreum*), and eight state-listed rare species were observed at MBSS sites in 2001:, ironcolor shiner (*Notropis chalybaeus*), logperch (*Percina caprodes*), mud sunfish (*Acantharchus pomotis*), flier (*Centrarchus macropterus*), banded sunfish (*Enneacanthus obesus*), swamp darter (*Etheostoma fusiforme*), comely shiner (*Notropis amoenus*), and shield darter (*Percina peltata*). Complete taxa lists of fish, benthic macroinvertebrates, amphibians, and reptiles observed in each PSU are included in Chapter 4 of this report.

Two glassy darters were found at one site in Western Branch. Twenty ironcolor shiners (at 1 site), 23 fliers (at 2 sites),and 6 swamp darters (at 2 sites) were found in Zekiah Swamp. The swamp darter was also found in Dividing Creek (8 individuals at 3 sites), Nassawango Creek (3 at 1 site), Nanticoke River (1 at 1 site), and Upper Pocomoke (2 at 1 site). Dividing Creek and Nassawango Creek also had mud sunfish (18 at 3 sites and 2 at 2 sites, respectively) and banded sunfish (36 at 3 sites and 26 at 3 sites, respectively). Banded sunfish were also found in Upper Pocomoke (58 at 4 sites). Further west, the following fish were found: logperch in Deer Creek (9 at 1 site), comely shiner at Piscataway Creek (29 at 1 site) and Sideling Hill Creek (2 at 2 sites), and shield darter at Deer Creek (58 at 3 sites) and Little Gunpowder Falls (17 at 2 sites).

In addition to state-listed fish species, four species found at less than 2% of the MBSS sites sampled in Round One were also sampled in 2001: American brook lamprey (*Lampetra appendix*), warmouth (*Lepomis gulosus*), rainbow darter (*Etheostoma caeruleum*), and johnny darter (*Etheostoma nigrum*). The American brook lamprey was found at 1 site in Patuxent River Middle and 4 sites in Western Branch. The warmouth was found at two sentinel sites (in Lower Chester River and Mattawoman Creek), Stillpond-Fairlee, and 4 sites in Zekiah Swamp. The rainbow darter was found at 3 sites in Sideling Hill, while the johnny darter was found at 1 site in Youghiogheny River.

3.2 BIOLOGICAL INDICATORS

The Index of Biotic Integrity (IBI) is a stream assessment tool that evaluates biological integrity based on characteristics of the fish or benthic assemblage at a site. Biological integrity is defined as

> *the ability to support and maintain a balanced, integrated, adaptive community of organisms having a species composition, diversity, and functional organization comparable to that of the natural habitat of the region.*
>
> -- Karr and Dudley (1981) as cited in Karr (1991)

To develop an IBI, reference sites are selected to represent regional natural habitats, also referred to as “minimally impacted” conditions. We recognize that virtually no streams in Maryland are entirely undisturbed by human activities. Atmospheric deposition of contaminants alone reaches all parts of the State; few streams have natural temperature regimes; and more than 1,000 man-made barriers to fish migration have been documented in Maryland. Therefore, reference conditions currently in use should not be viewed as completely natural or pristine.

They are, however, a representative sample of the best streams that currently exist in the State. Whether these conditions are the best attainable depends on future restoration activities and the goals of DNR, other agencies, and the public.

Sites were evaluated using both the fish and benthic IBIs developed for the MBSS, indicators previously employed in evaluating Round One results (Roth et al. 1999). For details about IBI development, see Roth et al. (2000) and Stribling et al. (1998). IBI scores for each site were determined by comparing the fish or benthic assemblage to those found at minimally impacted reference sites. Three separate formulations were employed for the fish IBI, one for each of three distinct geographic areas: Coastal Plain, Eastern Piedmont, and Highlands. Two different formulations of the benthic IBI were used in the Coastal Plain and non-Coastal Plain regions. IBIs were calibrated specifically for each ecological region during their development.

The MBSS computes the IBI as the average of individual metric scores. Individual metric scores are based on comparison with the distribution of metric values at reference sites within each geographic stratum. Metrics are scored 1 (if < 10th percentile of reference value), 3 (10th to 50th percentile), or 5 ($\geq$ 50th percentile). The final IBI scores are calculated as the average of three scores and therefore range from 1 to 5. An IBI $\geq$ 3 indicates the presence of a biological community with attributes (metric values) comparable to those of reference sites, while an IBI < 3 means that, an average, metric values fall short of reference expectations. Table 3-1 contains narrative descriptions for each of the IBI categories developed for the Survey.

Because an IBI score of 3 represents the threshold of reference condition, values less than 3 (i.e., poor or very poor) represent sites suspected to be degraded. In contrast, values greater than or equal to 3 (i.e., fair or good) indicate that most attributes of the community are within the range of those at reference sites. Highest scores (IBI of 4 to 5) were designated as good, recognizing that available reference sites do not necessarily represent the highest attainable condition nor are these sites pristine or completely natural. The assignment of scores to narrative categories is a useful method for translating scores into a form that is easily communicated.

The sections below contain a summary of biological indicator results for MBSS core sites sampled in 2001. Included are the fish IBI, benthic IBI, and an integrated summary of both bioindicators, the Combined Biotic Index (CBI), the average of the fish and benthic IBIs or if only one IBI exists for a site that score is used.

3.2.1 Fish IBI Results

Although a target of sampling 10 sites per PSU was set, in some cases fewer than 10 sites received fish IBI scores (Table 3-2). A total of 199 core sites in 19 PSUs were sampled for fish during summer 2001. Of these sites, 41 sites were not rated by the fish IBI, as they were very small headwater streams (each with a catchment area less than 300 acres) where expectations of fish abundance and diversity are too low for development of an effective indicator.

Table 3-1. Narrative descriptions of stream biological integrity associated with each of the IBI categories

Good	IBI score 4.0 - 5.0	Comparable to reference streams considered to be minimally impacted. On average, biological metrics fall within the upper 50% of reference site conditions.
Fair	IBI score 3.0 - 3.9	Comparable to reference conditions, but some aspects of biological integrity may not resemble the qualities of these minimally impacted streams. On average, biological metrics fall within the lower portion of the range of reference sites (10th to 50th percentile).
Poor	IBI score 2.0 - 2.9	Significant deviation from reference conditions, with many aspects of biological integrity not resembling the qualities of these minimally impacted streams, indicating degradation. On average, biological metrics fall below the 10th percentile of reference site values.
Very Poor	IBI score 1.0 - 1.9	Strong deviation from reference conditions, with most aspects of biological integrity not resembling the qualities of these minimally impacted streams, indicating severe degradation. On average, biological metrics fall below the 10th percentile of reference site values; most or all metrics are below this level.

Table 3-2. Number of sites electrofished in summer 2001 (by PSU), numbers of special cases, and number of sites available for fish IBI (FIBI) analysis					
PSU	**Number of Sites Fished**	**Number of Sites < 300 acres**	**Number of Brook Trout Sites with FIBI < 3**	**Number of Blackwater Sites with FIBI < 3**	**Number of sites Available for FIBI**
Youghiogheny River	16	3	0	0	13
Potomac River Upper North Branch	10	0	4	0	6
Potomac AL Co/Sideling Hill Creek	6	1	0	0	5
Seneca Creek	14	6	0	0	8
Piscataway Creek	10	1	0	0	9
Potomac Upper Tidal/Oxon Creek	10	3	0	0	7
Zekiah Swamp	13	3	0	0	10
Gilbert Swamp	10	4	0	0	6
Assawoman/Isle of Wight/Sinepuxent/Newport/ Chincoteague Bays	7	3	0	0	4
Western Branch	9	1	0	0	8
Patuxent River Middle	13	1	0	0	12
Bodkin Creek/Baltimore Harbor	10	3	0	0	7
Little Gunpowder Falls	10	3	0	0	7
Sasssafras River/Stillpond-Fairlee	9	2	0	0	7
Northeast River/Furnace Bay	9	1	0	0	8
Nanticoke River	8	2	0	0	6
Dividing Creek/Nassawango Creek	9	1	0	1	7
Upper Pocomoke River	12	0	0	1	11
Deer Creek	14	3	0	0	11
TOTAL	199	41	4	2	152

In addition, because the fish IBI may underrate coldwater and blackwater streams owing to their naturally low species diversity, evidence of these stream types was used as a secondary indicator in interpreting scores. Sites where brook trout were present (a clear sign of coldwater conditions) and where fish IBI scores were less than 3 were excluded from analysis and reported as "not rated." This situation was rare (4 sites). Along with low species richness, naturally acidic blackwater streams may also be dominated by a few acid-tolerant species. Because of the concern for possibly underrating blackwater streams, the 2 blackwater streams with fish IBI scores less than 3 were excluded from analysis and were instead classified as "not rated." Blackwater streams were defined as sites with either pH < 5 or ANC < 200 μeq/l and DOC > 8 mg/l. Over time, the Survey plans to build its database of coldwater and blackwater streams to the point where it can develop biological indicators particular to these special stream types. Other factors that may affect fish IBI scores should be considered in interpreting scores for individual sites. Sites with natural features such as bedrock substrate or a small, shallow stream channel may naturally support few species. Dams and other barriers to fish migration can block access to formerly inhabited upstream areas. In contrast, proximity of a site to a lake, pond, swamp, or impoundment can make a site more accessible to lentic species not typically found in the streams sampled by the Survey. Nearness to a large river confluence can similarly alter the pool of available species. Finally, high species richness owing to the presence of both Coastal Plain and Piedmont species at sites along the Fall Line may result in artificially high IBI scores in this transitional area.

Fish IBI scores for sites sampled in the 2001 MBSS spanned the full range of biological condition, from 1.0 (very poor) to 5.0 (good). Fish IBI data for each PSU are depicted in Figure 3-1 and listed in Appendix Table B-1. Mean fish IBIs for PSUs sampled in 2000 and 2001 are mapped in Figure 3-2. Over the next three years of Round Two sampling, data will be collected in remaining PSUs to complete an updated statewide picture of biological conditions. Mean fish IBI per PSU ranged from 1.90 (Potomac River Upper North Branch) to 3.86 (Little Gunpowder Falls).

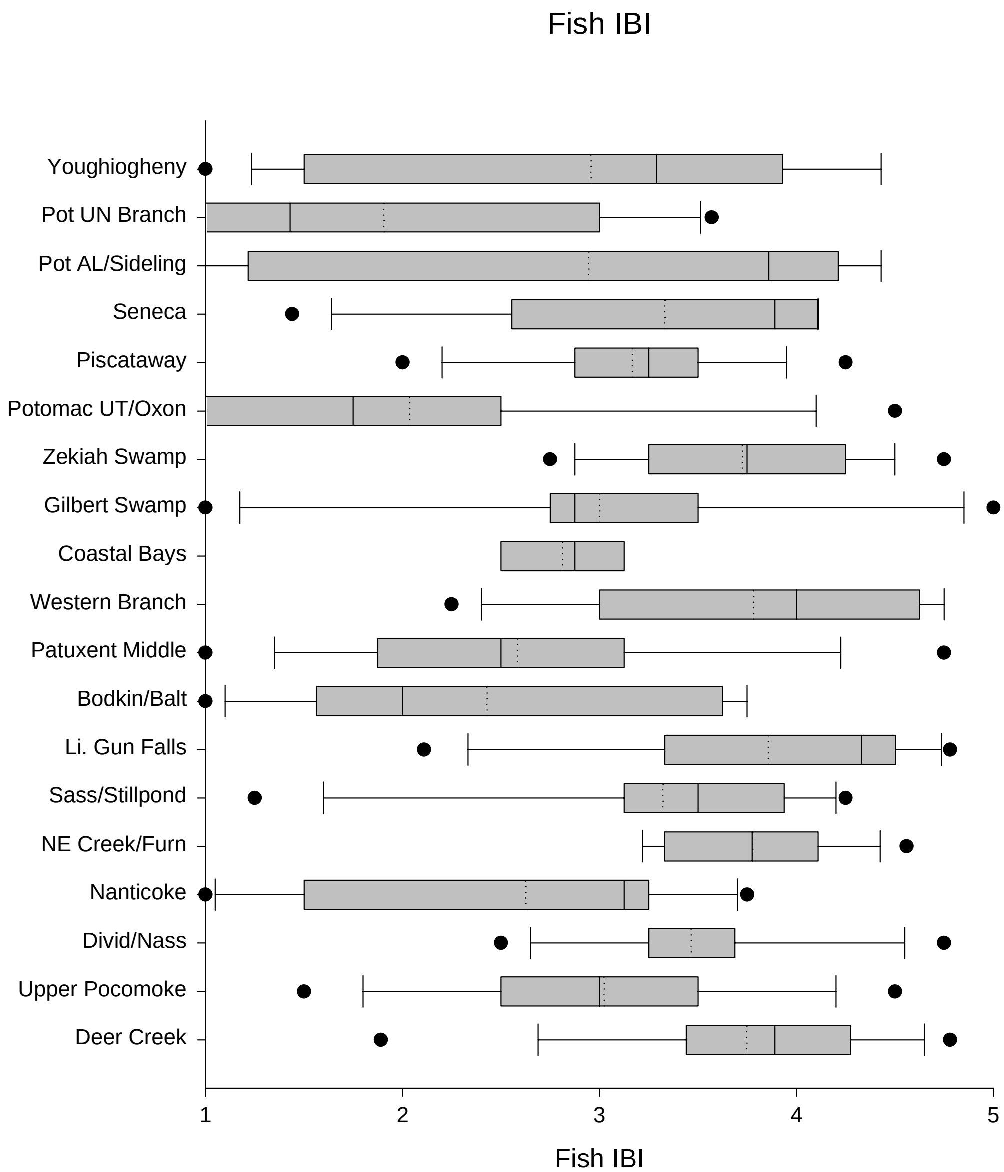


Figure 3-1. Distribution of fish Index of Biotic Integrity (IBI) scores for the MBSS PSUs sampled in 2001. The solid vertical line indicates the median value of the data, while the dotted line indicates the mean value. The grey box delineates the 25th and 75th percentiles of the data, while the whiskers indicate the 10th and 90th percentiles of the data. Dots indicate outliers.

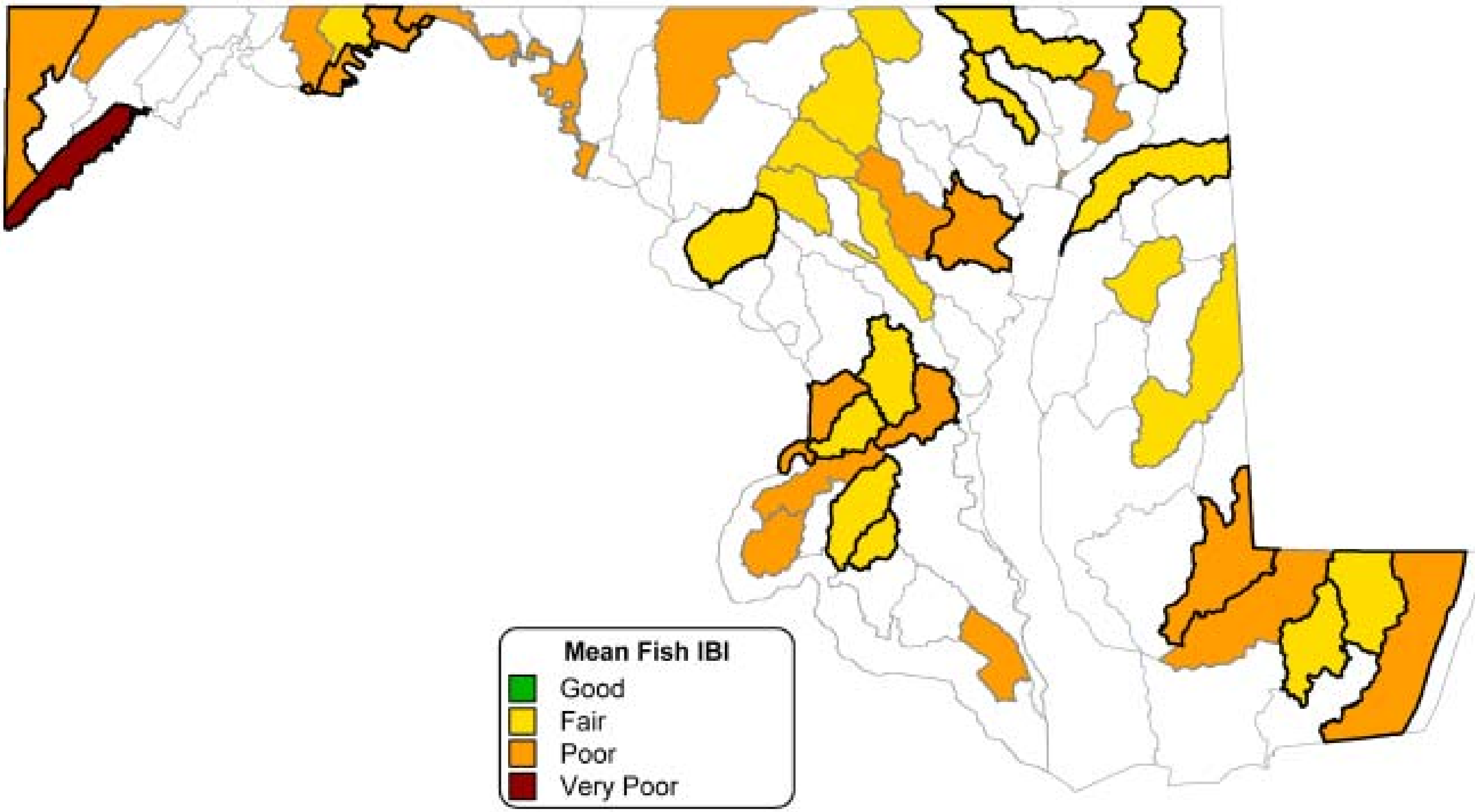


Figure 3-2. Mean fish Index of Biotic Integrity (IBI) in MBSS PSUs sampled in 2000 and 2001. PSUs sampled in 2001 have bolder outlines than those sampled in 2000.

Data were also used to estimate the extent of streams in poor to very poor condition within each PSU. The MBSS Round Two study design, based on simple random sampling, makes it possible to calculate an exact confidence interval around each estimate based on the binomial distribution. The extent of streams within a given condition (e.g., IBI < 3) is expressed as a percentage of all first-through fourth-order stream miles in the PSU, with an associated 90% confidence interval around the estimate. The 90% confidence interval was selected as the most appropriate for balancing the variability of the data and the need for information to support management decisions. This recognizes that requiring very high confidence can lead to an unnecessarily large number of decisions not to act.

Figure 3-3 shows the 90% confidence intervals for the percentage of stream miles with fish IBI < 3, by PSU. Values are listed in Appendix Table B-2. Results indicate that Northeast River/Furnace Bay has the least extensive occurrence of poor to very poor fish IBI scores. With 90% confidence, we can say that only 0-31% of stream miles in Northeast River/Furnace Bay PSU had poor to very poor fish IBI. In contrast, with 90% confidence we can say that 48 to 99% of stream miles in Potomac River Upper Tidal/ Oxon Creek PSU had poor to very poor fish IBI.

Note that confidence intervals are most narrow where (1) conditions tend to be homogeneous (i.e., one condition occurs at all or nearly all sites, whereas the alternative condition occurs at 0 or few sites) and (2) the number of samples is high. For PSUs with small sample size, the confidence interval is, as expected, fairly wide. For example, the four sites in Assawoman/Isle of Wight/ Sinepuxent/ Newport/Chincoteague Bays (hereafter referred to as Coastal Bays PSU) predict with 90% confidence that 10 to 90% of stream miles are in poor to very poor condition. Completion of all Round Two sampling by 2004 will allow estimation of statewide and basin-specific conditions. At the basin level, larger sample sizes will result in much narrower confidence intervals, with precision comparable to Round One basin results.

MBSS and Montgomery County Integration Study

Maryland DNR is currently working with several county stream monitoring programs to coordinate monitoring and assessment efforts. One of the issues being addressed is the feasibility of integrating results from both programs in order to arrive at a combined estimate of stream condition (e.g., mean fish or benthic IBI score) for the entire county or portion of the county. This integration offers two advantages:

- the elimination of multiple, conflicting estimates of stream condition generated by separate sampling programs; and
- an increase in precision of the MBSS estimate by increasing the size of the sample considered in the estimate.

Using methods developed in Volstad et al. (2002) and briefly described in Section 2.3 of this report, MBSS data and Montgomery County were integrated for the Seneca Creek watershed, which was sampled both by the County and by MBSS in 2001. The following table shows the results of this analysis. Note that the integrated mean values for both the benthic and fish IBIs were substantially more precise than the IBIs obtained from MBSS data alone. For example, the integrated standard error for the benthic IBI decreased from 0.22 (for MBSS data) and 0.21 (Montgomery County data) to 0.12. The site-specific results for the Montgomery County sites for which data were available, as well as the MBSS data, are displayed on the Seneca Creek PSU map located in Section 4 of this report.

Results of integrated MBSS and Montgomery County analysis, Seneca Creek watershed sampled in 2001

	Benthic IBI	Fish IBI
MBSS Sample Size	15	8
MBSS Mean Value	2.82	3.33
MBSS Standard Error	0.22	0.37
Montgomery County Sample Size	44	26
Montgomery County Mean Value	3.21	2.81
Montgomery County Standard Error	0.21	0.21
Integrated Mean Value	3.12	2.94
Integrated Standard Error	0.12	0.22

As more County data and other non-MBSS data becomes available to the MBSS, further integration in the applicable PSUs will be utilized. Where feasible, the integrated data will be used as a substitute for MBSS-only estimates of stream condition in support of water resources management.

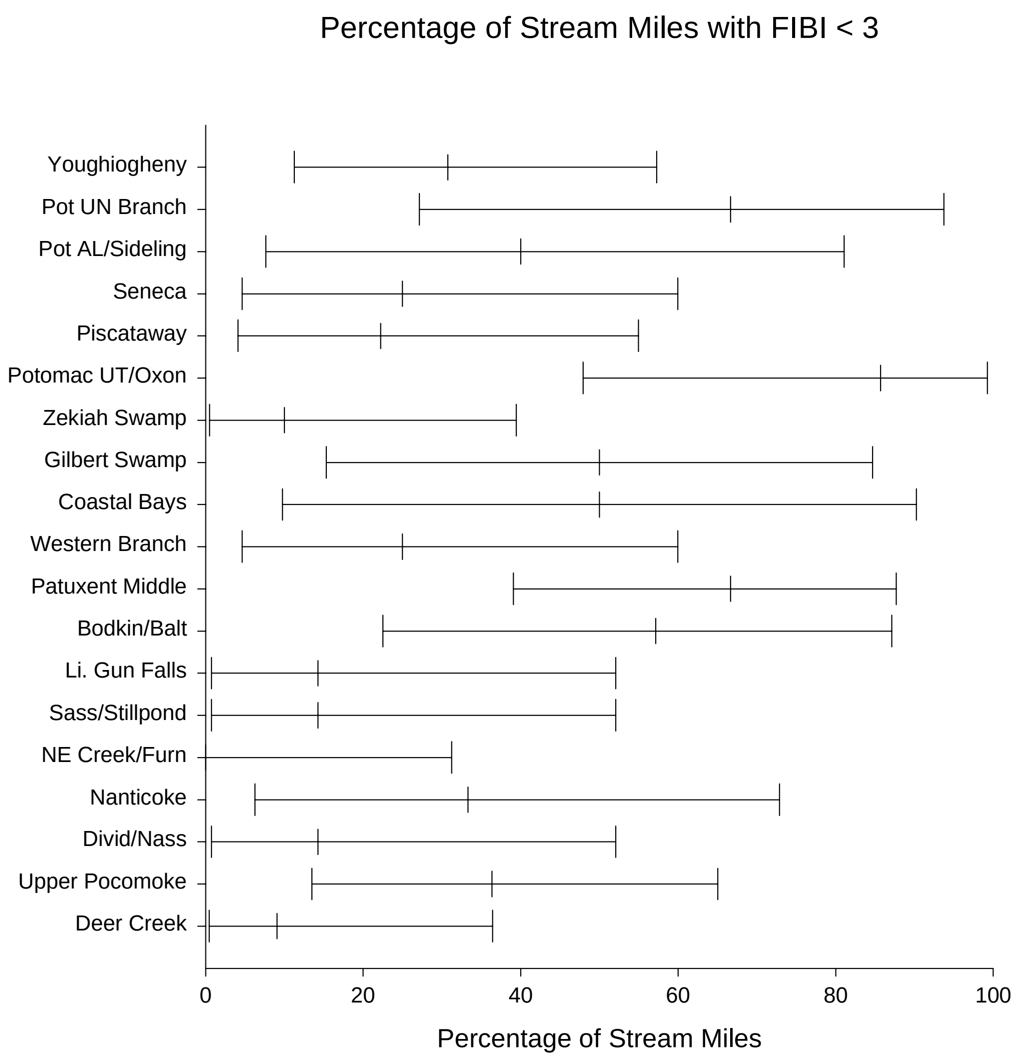


Figure 3-3. Percentage of stream miles with fish Index of Biotic Integrity (IBI) scores < 3.0 for the MBSS PSUs sampled in 2001

3.2.2 Benthic IBI Results

Benthic IBI scores were calculated for the 212 core sites sampled in spring 2001. Scores spanned the full range of biological conditions, from 1.0 (very poor) to 4.78 (good). Benthic IBI data for each PSU are shown in Figure 3-4 and listed in Appendix B-3. Mean benthic IBIs by PSU are mapped in Figure 3-5. The lowest mean benthic IBI was 1.60 in Coastal Bays PSU. The highest mean benthic IBI as 4.17 in Deer Creek PSU.

The extent of occurrence of streams with benthic IBI < 3 were calculated, along with 90% confidence intervals. Values are listed in Appendix Table B-4. As shown in Figure 3-6, an estimated 72 to 100% of stream miles in Piscataway Creek PSU had benthic IBI < 3, as did an estimated 65 to 100% of stream miles in Potomac River Upper Tidal/Oxon Creek PSU and an estimated 47 to 100% in Coastal Bays PSU. In contrast, estimates for several other PSUs indicated less extensive occurrence of low benthic IBI. For example, an estimated 0 to 26% of stream miles in Zekiah Swamp PSU, 0 to 31% of stream miles in Northeast River/Furnace Bay PSU, and 0 to 45% of stream miles in Potomac River Allegany County/Sideling Hill Creek PSU had benthic IBI < 3.

A snapshot of good and bad conditions is illustrated by sites with the 10 best and 10 worst Combined Biotic Index (CBI) scores. Sites with the best scores were distributed across the state. As expected, many drained forested catchments less disturbed by human impacts. None had a high degree of urbanization. The relative influence of agriculture varied, but the best sites highlighted here tended to have good riparian buffer and good physical habitat, even when located in a highly agricultural catchment.

10 best sites in watersheds sampled by MBSS 2001, as rated by the Combined Biotic Index (CBI)

Stream Name	SITEYR	Order	Basin	Watershed Name	CBI
Mill Run	YOUG-221-R-2001	2	Youghigheny River	Youghiogheny River	4.60
Wet Stone Branch	DEER-113-R-2001	1	Susquehanna River	Deer Creek	4.56
Deer Creek	DEER-408-R-2001	4	Susquehanna River	Deer Creek	4.56
Little Gunpowder Falls	LIGU-105-R-2001	1	Gunpowder River	Little Gunpowder Falls	4.56
McMillan Fork of Shields Run	PRUN-102-R-2001	1	North Branch Potomac River	Potomac River Upper North Branch	4.56
Zekiah Swamp Run	ZEKI-305-R-2001	3	Lower Potomac River	Zekiah Swamp	4.48
Zekiah Swamp Run UT1	ZEKI-215-R-2001	2	Lower Potomac River	Zekiah Swamp	4.45
Deer Creek	DEER-302-R-2001	3	Susquehanna River	Deer Creek	4.44
Little Gunpowder Falls	LIGU-201-R-2001	2	Gunpowder River	Little Gunpowder Falls	4.44
Little Gunpowder Falls	LIGU-312-R-2001	3	Gunpowder River	Little Gunpowder Falls	4.44
West Branch (of Northeast Creek)	NEAS-103-R-2001	1	Elk River	Northeast River	4.44

Sites with the worst scores represented a broad range of stream problems. Significant impacts are noted at urban streams in heavily developed areas with extensive impervious surface and little or no riparian vegetation agricultural impacts were noted at several streams in southern Maryland and on the eastern shore. Channelization was common in both rural and urban streams.

10 worst sites in watersheds sampled by MBSS 2001, as rated by the Combined Biotic Index (CBI)

Stream Name	SITEYR	Order	Basin	Watershed Name	CBI
Cabin Branch UT1	BALT-103-R-2001	1	Patapsco River	Baltimore Harbor	1.00
Marley Creek UT3	BALT-106-R-2001	1	Patapsco River	Baltimore Harbor	1.00
Fivemile Branch	CHIN-112-R-2001	1	Ocean Coastal	Chincoteague Bay	1.00
Oxon Run UT1	OXON-205-R-2001	2	Potomac Washington Metro	Oxon Creek	1.00
Oxon Run	OXON-101-R-2001	1	Potomac Washington Metro	Oxon Creek	1.29
Henson Creek UT2	PRUT-107-R-2001	1	Potomac Washington Metro	Potomac River Upper Tidal	1.29
Marley Creek	BALT-104-R-2001	1	Patapsco River	Baltimore Harbor	1.29
Pusey Branch	DIVI-107-R-2001	1	Pocomoke River	Dividing Creek	1.29
Tukesburg Branch	NEWP-110-R-2001	1	Ocean Coastal	Newport Bay	1.29
Old Mill Branch	UPPC-101-R-2001	1	Pocomoke River	Upper Pocomoke River	1.29
Bowling Creek	ZEKI-118-R-2001	1	Lower Potomac	Zekiah Swamp	1.29

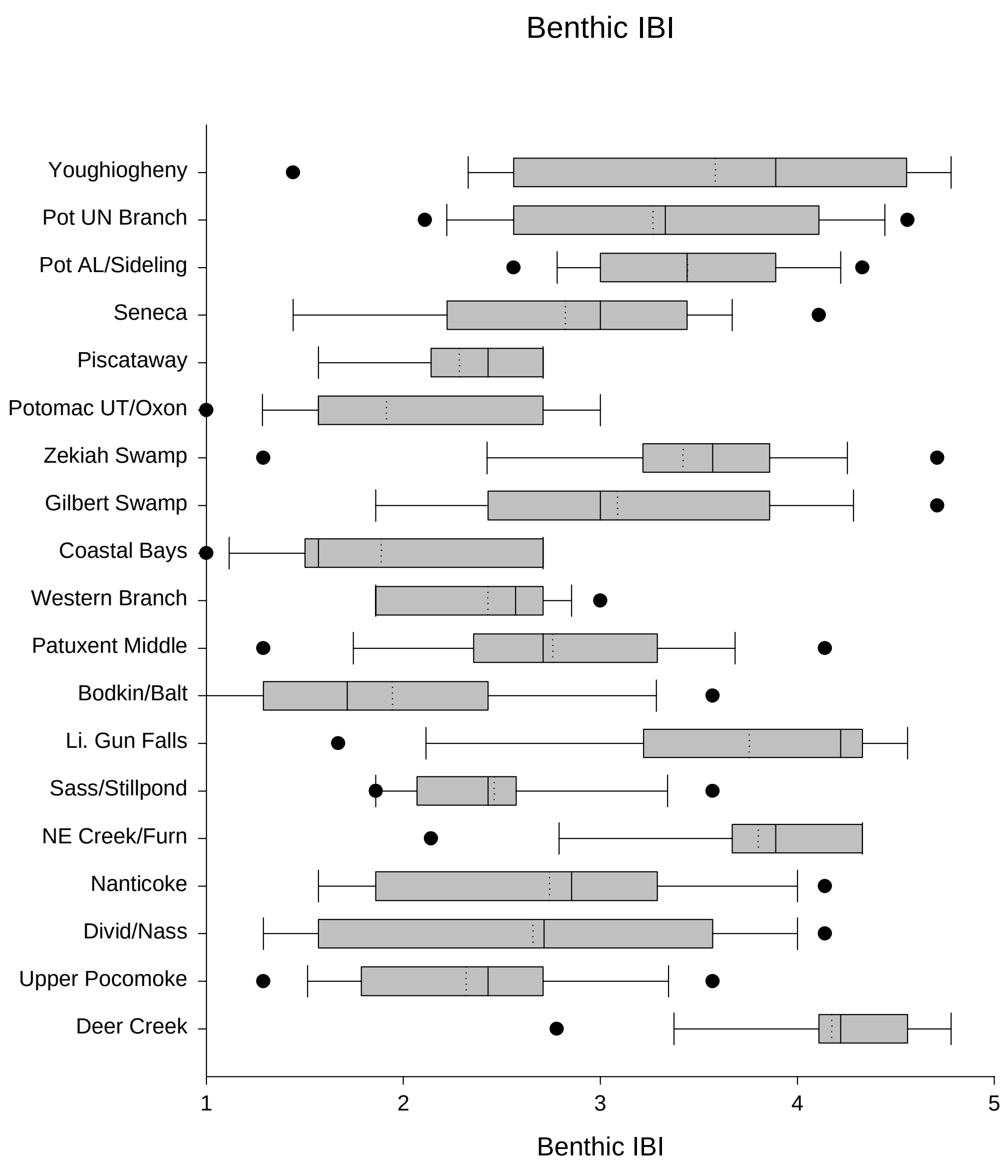


Figure 3-4. Distribution of benthic Index of Biotic Integrity (IBI) scores for the MBSS PSUs sampled in 2001

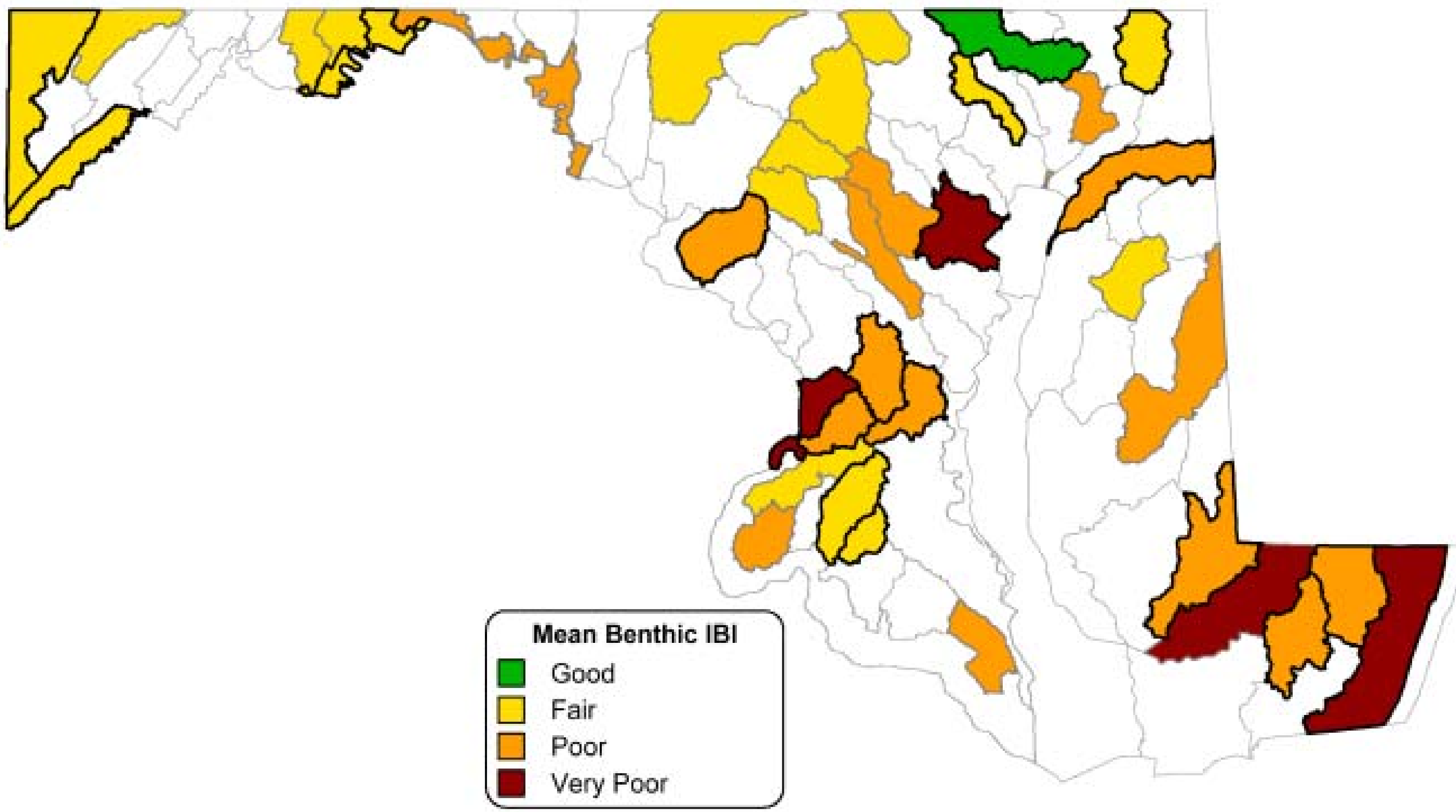


Figure 3-5. Mean benthic Index of Biotic Integrity (IBI) in MBSS PSUs sampled in 2000 and 2001. PSUs sampled in 2001 have bolder outlines than those sampled in 2000.

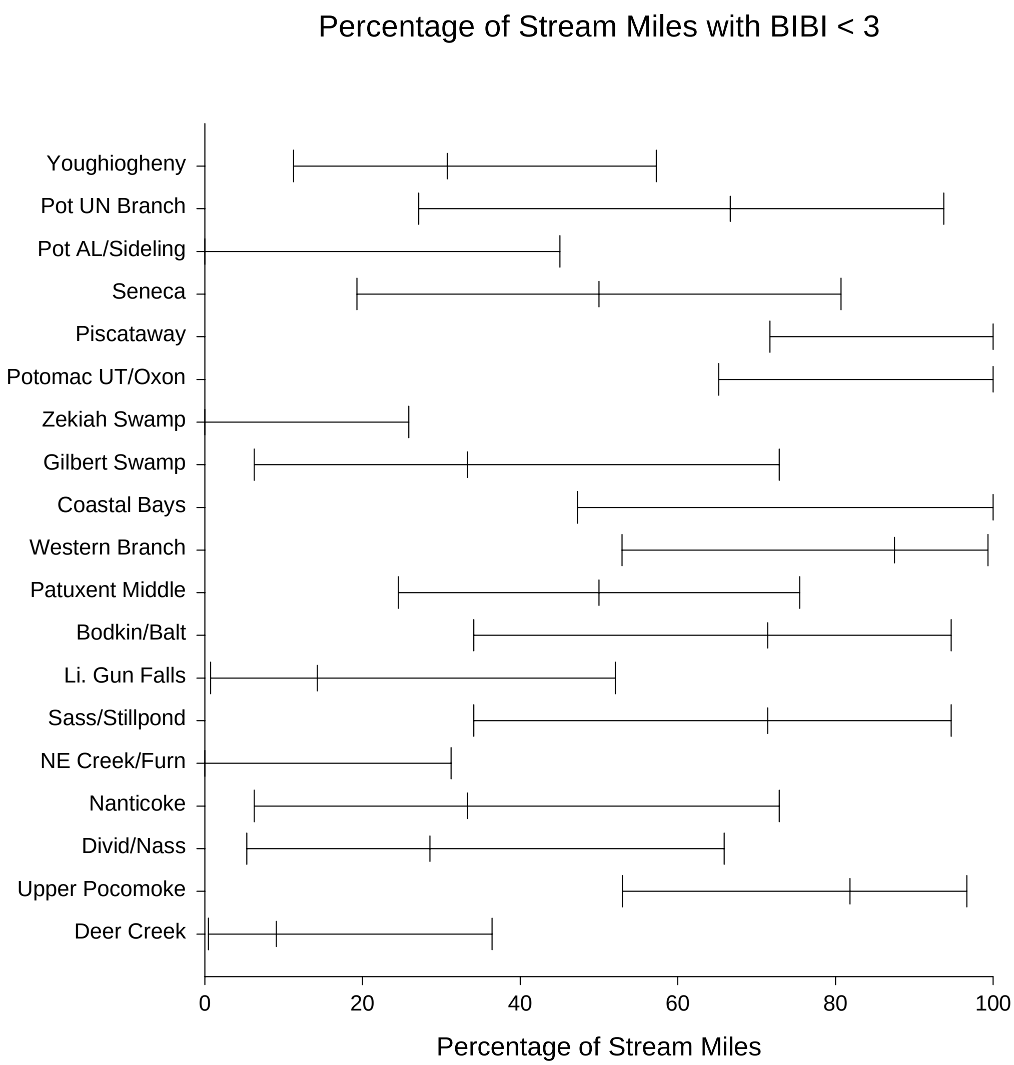


Figure 3-6. Percentage of stream miles with benthic Index of Biotic Integrity (IBI) scores < 3.0 for the MBSS PSUs sampled in 2001

3.2.3 Combined Biotic Index Results

To integrate the results of fish and benthic IBI assessments, a Combined Biotic Index (CBI) was assigned to each site. If both IBI scores were available for a site, the CBI was calculated as the mean of the fish and benthic IBI values. If only one score was available (e.g., benthic IBI but no fish IBI), the single score was assigned as the CBI. Interpretation of CBI scores follows the guidelines in Table 3-2.

CBI scores from core MBSS sites ranged from 1.00 (very poor) to 4.60 (good). CBI data for each PSU are depicted in Figure 3-7 and listed in Appendix Table B-5. Mean CBI values by PSU are mapped in Figure 3-8. Mean CBI per PSU ranged from 1.96 (Coastal Bays PSU) to 3.98 (Deer Creek), paralleling benthic IBI results. The 90% confidence intervals for percentage of stream miles with CBI < 3 are shown in Figure 3-9 and Appendix Table B-6.

3.3 ACIDIFICATION

The effects of acidic deposition and acid mine drainage (AMD) on stream chemistry are well documented. Maryland's 1987 Synoptic Stream Chemistry Survey (MSSCS; Knapp et al. 1988) concluded that approximately one-third of all headwater streams in Maryland are sensitive to acidification or are already acidic. Acidification is known to cause declines in both the diversity and abundance of aquatic biota. Round One MBSS results (Roth et al. 1999) and an assessment of these results in comparison with critical loads (Miller et al. 1998) confirmed that stream acidification remains a problem in Maryland freshwater streams.

The defining characteristics of surface waters sensitive to acidification are low to moderate pH and acid neutralizing capacity (ANC). pH is a measure of the acid balance of a stream. The pH scale ranges from 0 to 14, with pH 7 as neutral and pH < 7 signifying acidic conditions. Biological effects are often noted at pH < 5 or 6, except in naturally acidic systems where aquatic biota can tolerate low pH. ANC is a measure of the capacity of dissolved constituents in the water to react with and neutralize acids and is used as an index of the sensitivity of surface water to acidification. The higher the ANC, the more acid a system can assimilate before experiencing a decrease in pH. Repeated additions of acidic materials can cause a decrease in ANC. In many acidic deposition studies (e.g., Schindler 1988), an ANC of 200 µeq/l is considered the threshold for defining acid-sensitive streams and lakes.

By measuring pH, ANC, and several analytes indicative of potential acidification sources (e.g., sulfate, nitrate nitrogen, dissolved organic carbon (DOC), and agricultural land use), the Survey provides an opportunity to examine the current extent and distribution of stream acidification in Maryland watersheds. Results from the 2001 MBSS sampling are presented below.

3.3.1 Low pH

During spring 2001 sampling, sites in 8 of 19 PSUs sampled exhibited pH < 5. Sites in 14 PSUs had pH < 6. One PSU sampled had mean pH < 6 during spring - Dividing Creek/Nassawango Creek. Spring pH values are shown in Figure 3-10. Spring pH values of individual sites are depicted in Figure 3-11. Typically, spring pH values are slightly lower than summer because of episodic acidification from spring rain events. As expected, pH tended to be slightly higher in most PSUs during summer.

Results were used to estimate the extent of low spring pH conditions within each PSU as the percentage of stream miles with pH < 6 (Figure 3-12, Appendix Table B-7). For spring 2001, the greatest extent of low pH was estimated in Dividing Creek/Nassawango Creek, where the 90% confidence interval indicated 22 to 78% of stream miles had pH < 6. Several other PSUs had slightly lower percentages of stream miles with pH < 6 . Note that even in the five PSUs where no pH values < 6 were observed, the upper limit of the 90% confidence interval ranged from 18 to 26%, indicating the potential for low pH conditions to exist. For summer 2001 (Appendix Table B-8), the greatest extent of low pH was estimated in Dividing Creek/Nassawango Creek, where the 90% confidence interval indicated 22 to 78% of stream miles had pH < 6, the same as the spring estimate for this PSU.

3.3.2 Low Acid Neutralizing Capacity

Although pH is the most commonly used measure of acidification, ANC is a better overall measure of acidification and acid sensitivity, because it also indicates which systems are likely to become acidified under episodic conditions. The following critical ANC values are used to characterize streams according to acid sensitivity: < 0 µeq/l (acidic), 0 < ANC < 50 µeq/l (highly sensitive to acidification), 50 < ANC < 200 µeq/l (sensitive to acidification), and > 200 µeq/l (not sensitive to acidification).

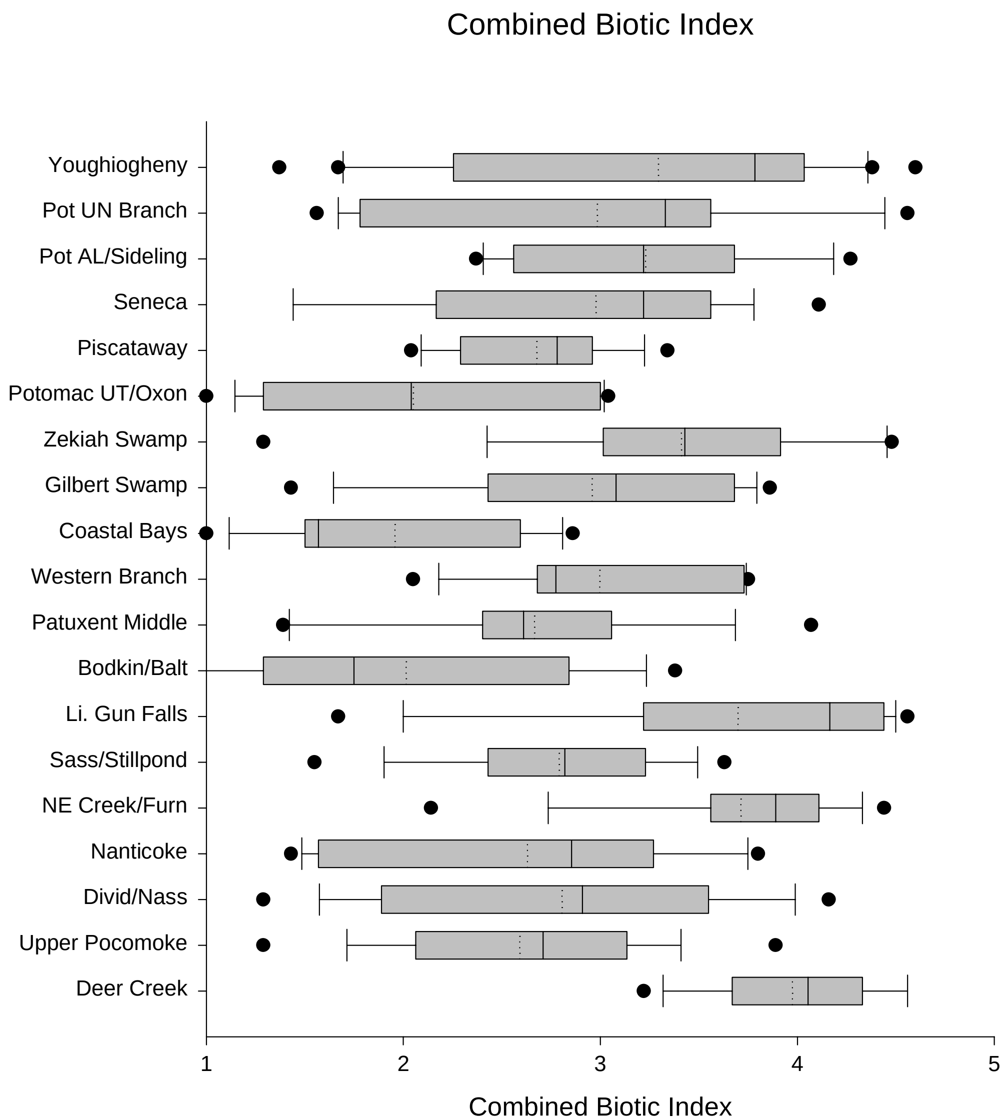


Figure 3-7. Distribution of the Combined Biotic Index (CBI) for the MBSS PSUs sampled in 2001

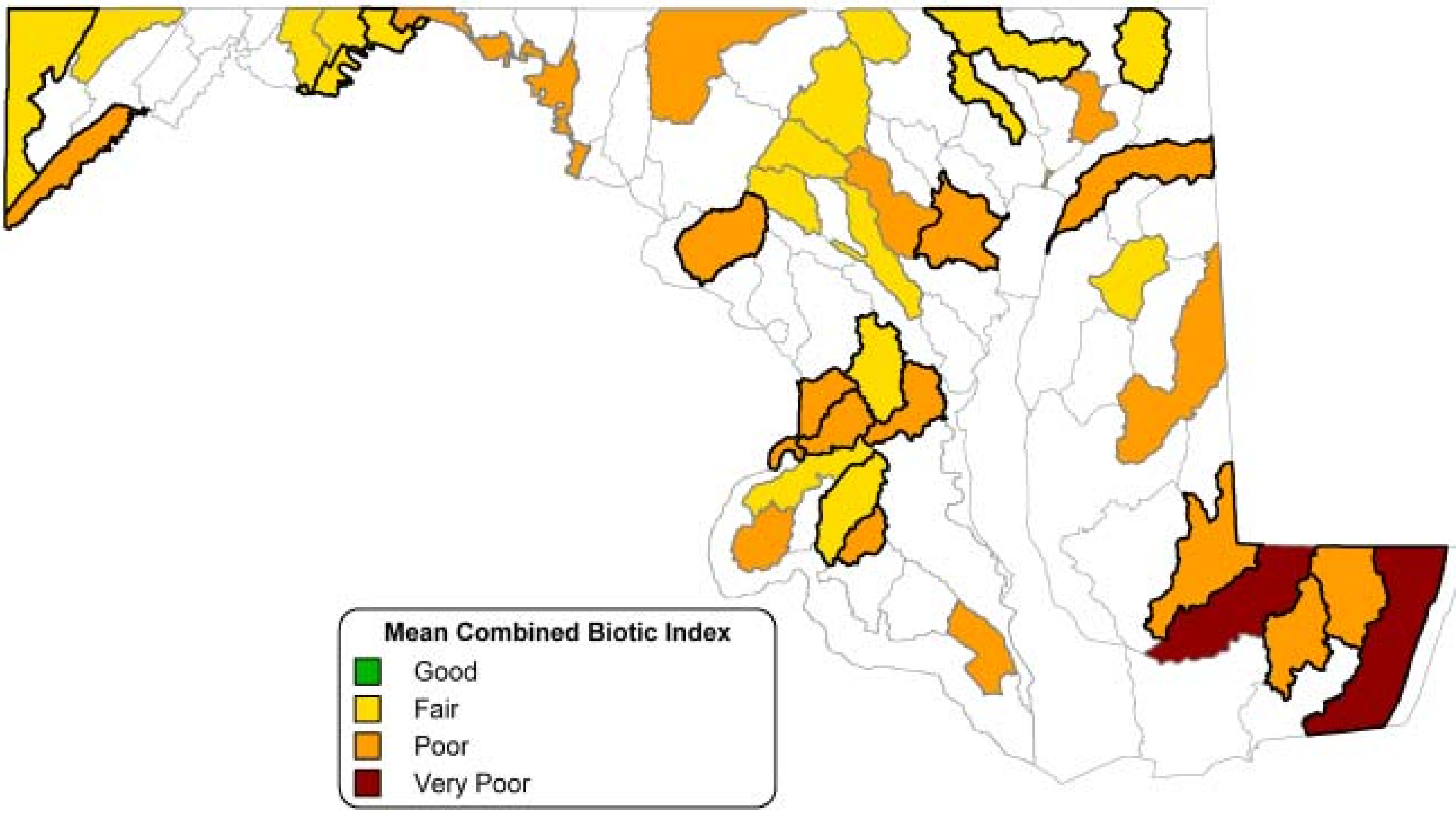


Figure 3-8. Mean Combined Biotic Index (CBI) in MBSS PSUs sampled in 2000 and 2001. PSUs sampled in 2001 have bolder outlines than those sampled in 2000.

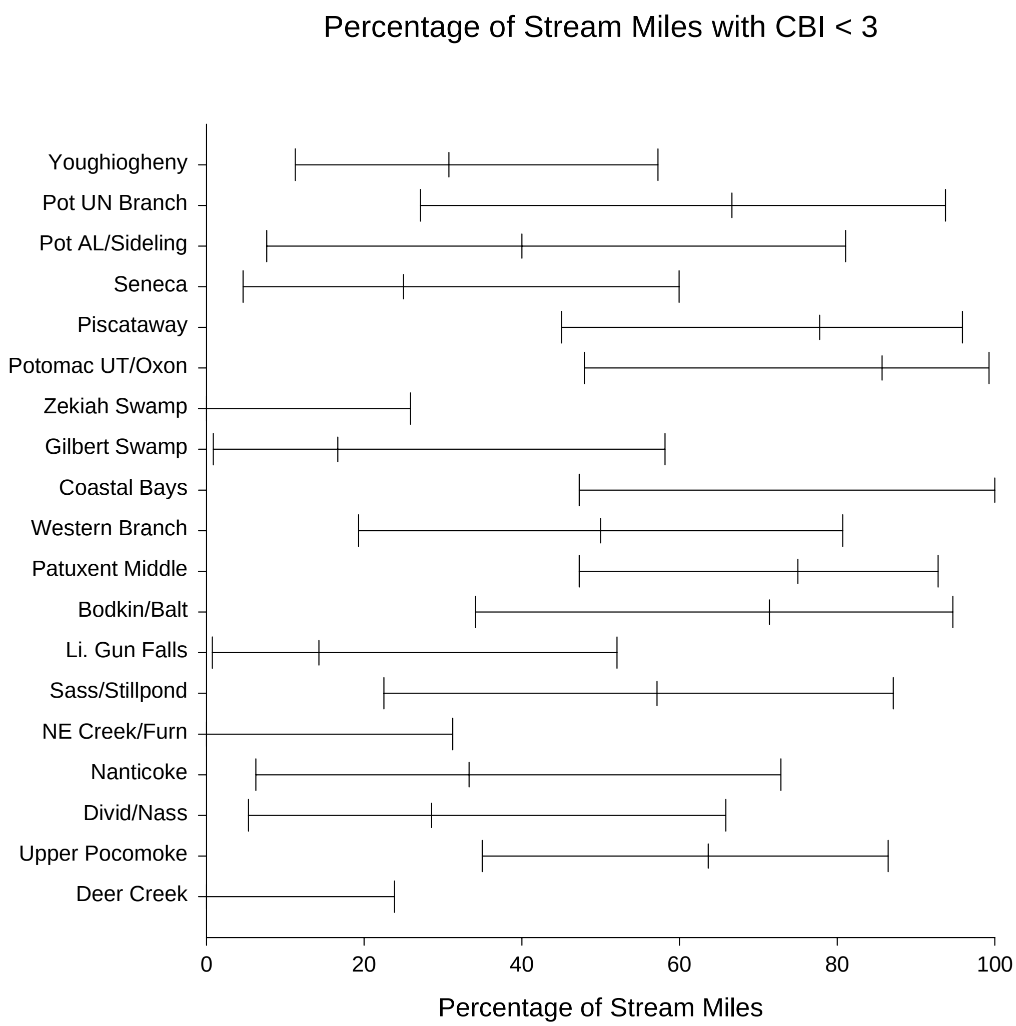


Figure 3-9. Percentage of stream miles with Combined Biotic Index (CBI) scores < 3.0 for the MBSS PSUs sampled in 2001

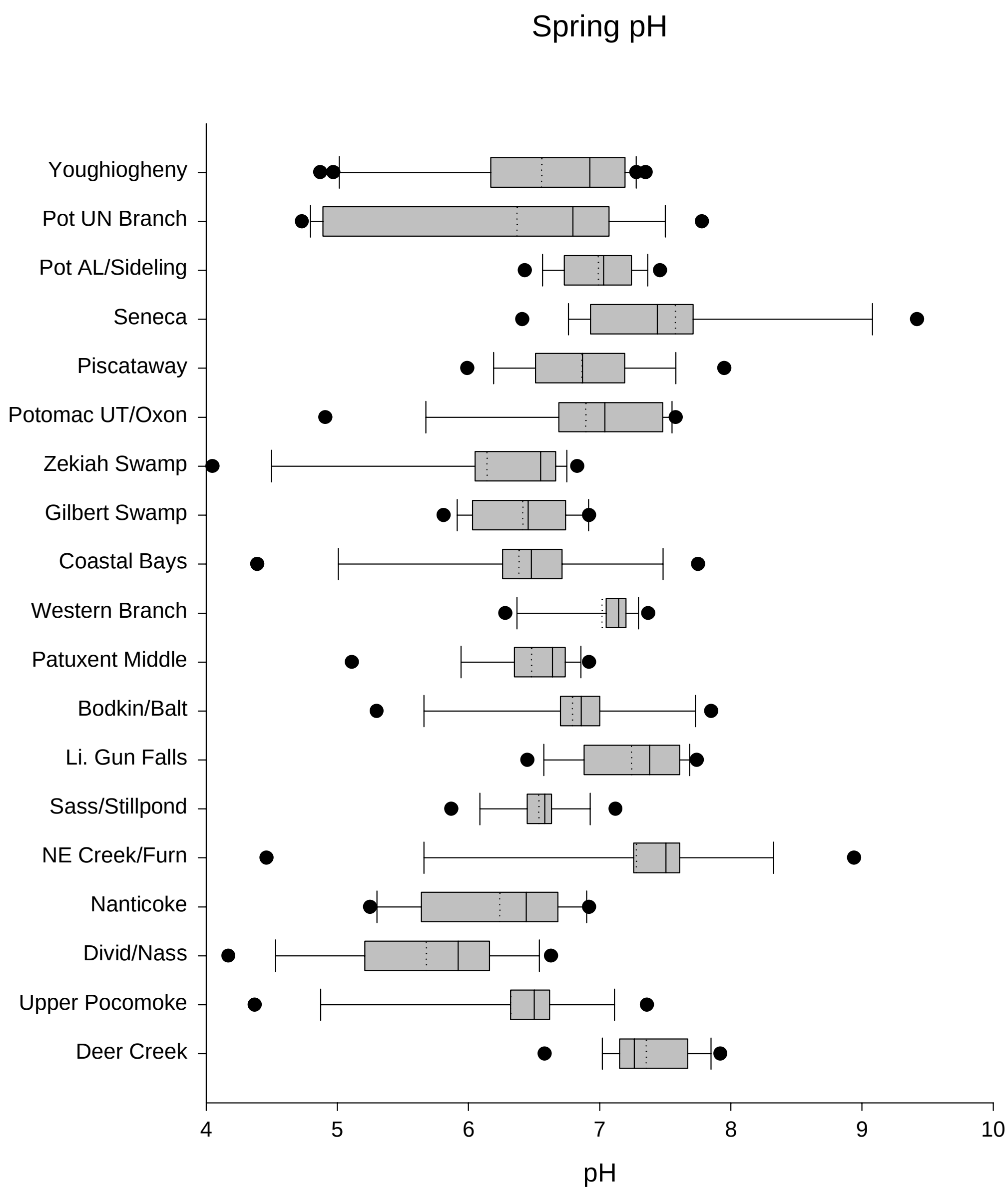


Figure 3-10. Distribution of spring pH values for the MBSS PSUs sampled in 2001

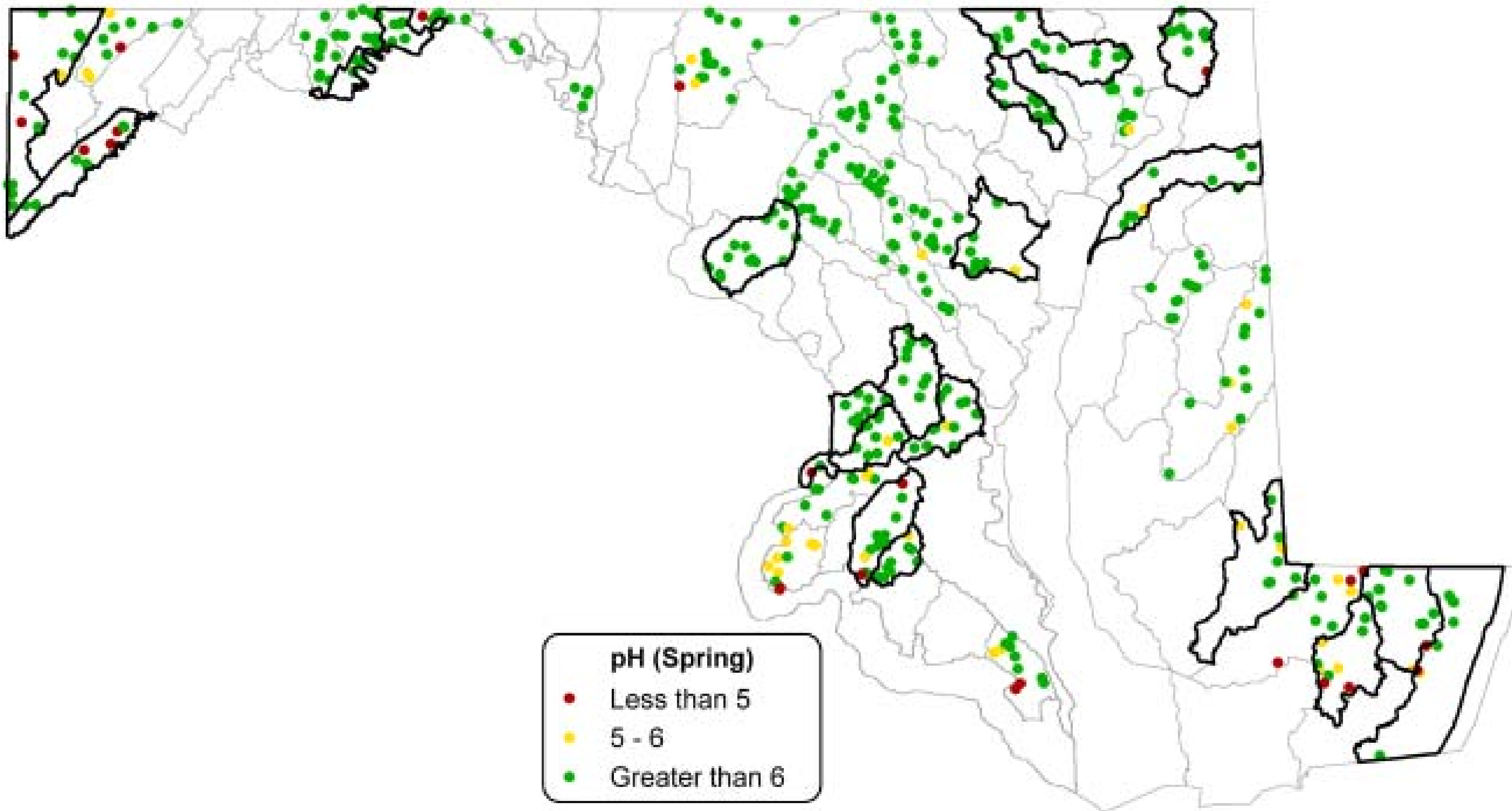


Figure 3-11. Distribution of spring pH values for sites sampled in the 2000 and 2001 MBSS. PSUs sampled in 2001 have bold outlines.

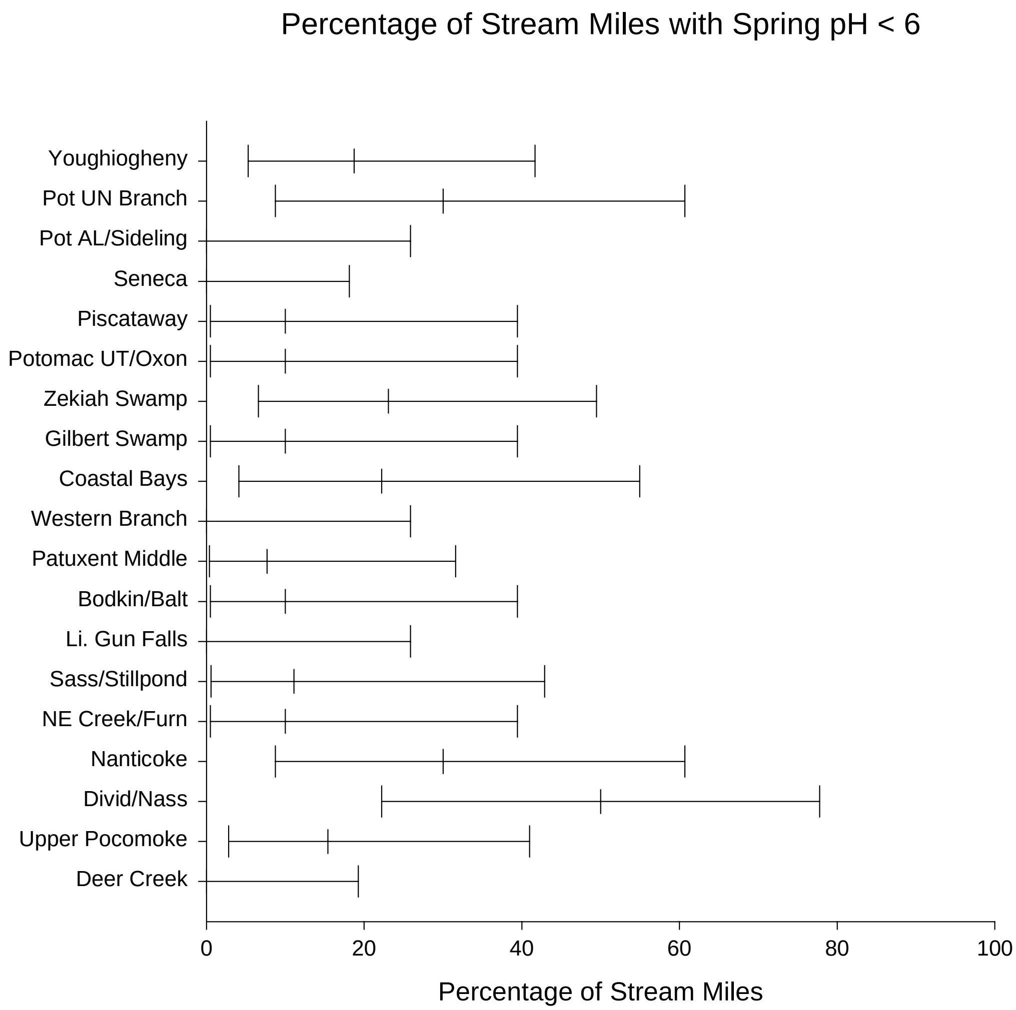


Figure 3-12. Percentage of stream miles with spring pH < 6.0 for the MBSS PSUs sampled in 2001

ANC values measured during spring 2001 are shown in Figures 3-13 and 3-14. Ten PSUs, primarily those in Western Maryland and the Southern Coastal Plain, had sites with ANC < 50 µeq/l. As shown in Figure 3-15 (Appendix Table B-9), PSUs with the greatest estimated stream length with ANC < 50 µeq/l were Potomac River Upper North Branch, Dividing Creek/Nassawango Creek, Zekiah Swamp, and Nanticoke River. Estimates of the percentage of stream miles with ANC < 200 µeq/l follow the geographic pattern noted in the MSSCS and Round One MBSS, with the greatest extent of acid-sensitive streams in Western Maryland and the Southern Coastal Plain (Figure 3-16, Appendix Table B-10).

3.3.3 Likely Sources of Acidity

In estimating the extent of acidification of Maryland streams, it is important to understand how acidic deposition, acid mine drainage, agricultural runoff, and natural organic materials contribute to the observed acidification. Acidic deposition is the contribution of material from atmospheric sources, both as precipitation (wet) and particulate (dry) deposition. Acidic deposition is generally associated with elevated concentrations of sulfate and nitrate in precipitation. AMD results from the oxidation of iron and sulfur from mine spoils and abandoned mine shafts and is known to cause extreme acidification of surface waters. Streams strongly impacted by AMD exhibit high levels of sulfate, manganese, iron, and conductivity. A third source of acidification is surface runoff from agricultural lands that are fertilized with high levels of nitrogen or other acidifying compounds. Lastly, the natural decay of organic materials may contribute acidity in the form of organic anions, as in blackwater streams associated with bald cypress wetlands. Streams dominated by organic sources of acidity are often characterized by high concentrations of dissolved organic carbon and organic anions. Available water chemistry and land use data were used to screen for likely acidifying sources following the method employed in Round One analysis (Roth et al.1999).

Results of the 2001 acid source screening indicate patterns that closely follow the results found in Round One of the Survey. A total of 101 sites (approximately 47%) sampled in 2001 had ANC < 200 µeq/L, an indication of acidification or acid sensitivity. Evidence of AMD was found at four sites in the Potomac River Upper North Branch PSU, while one site in the Youghiogheny River PSU was likely affected by both AMD and acidic deposition. Organic ions contributed to the acidification of one site in the Coastal Bays PSU. Both organic ions and acidic deposition affected sites in Coastal Bays PSU (1 site), Dividing Creek/ Nassawango Creek (6 sites), Nanticoke River (1 site), Potomac River Upper Tidal/Oxon Creek (1 site), Sassafras River/Stillpond-Fairlee (1 site), and Upper Pocomoke River (2 sites). Agriculture contributed to acidification at sites in Deer Creek (2 sites), Nanticoke River (3 sites), Patuxent River Middle (5 sites), Seneca Creek (2 sites), Sassafras River/Stillpond-Fairlee (2 sites), and Upper Pocomoke River (4 sites). According to screening criteria, acidic deposition effects were more widespread, affecting PSUs throughout the State. Sixty-five sites were affected in 12 PSUs, located mainly in western and southern Maryland: Bodkin Creek/Baltimore Harbor (1 site), Deer Creek (1 site), Dividing Creek/Nassawango Creek (4 sites), Gilbert Swamp (9 sites), Nanticoke River (1 site), Northeast River/Furnace Bay (2 sites), Patuxent River Middle (5 sites), Piscataway Creek (3 sites), Potomac River Allegany County/Sideling Hill Creek (7 sites), Western Branch (2 sites), Youghiogheny River (13 sites), and Zekiah Swamp (13 sites). Only one PSU sampled in 2001, Little Gunpowder Falls, located in central Maryland, showed no effects of acidification.

3.4 PHYSICAL HABITAT

Although many water resource programs tend to focus on water chemistry-based definitions of stream quality, physical habitat degradation can have an equal or greater effect on stream ecosystems and their biological communities. Habitat loss and degradation has been identified as one of six critical factors affecting biological diversity in streams worldwide (Allan and Flecker 1993). Habitat degradation can result from a variety of human impacts occurring within the stream itself and in the surrounding riparian zone and watershed. Typical instream impacts include sedimentation, impoundment, and stream channelization. Urban development, timber harvesting, agriculture, livestock grazing, and the draining or filling of wetlands are well-known examples of human activities affecting streams at a broader scale. In watersheds impacted by anthropogenic stress, riparian (streamside) forests can ameliorate inputs of nutrients, sediments, and other pollutants to streams. They also provide other functions, such as shade, overhead cover, and inputs of leaf litter and large woody debris.

The Survey collects data to assess the extent and type of physical habitat degradation occurring in Maryland streams. A provisional Physical Habitat Index (PHI), developed during MBSS Round One, was used to assess the overall status of physical habitat conditions. In addition, examination of individual parameters are useful for assessing geomorphic processes, integrity of riparian vegetation, and alterations to natural temperature regimes. Data from 2001

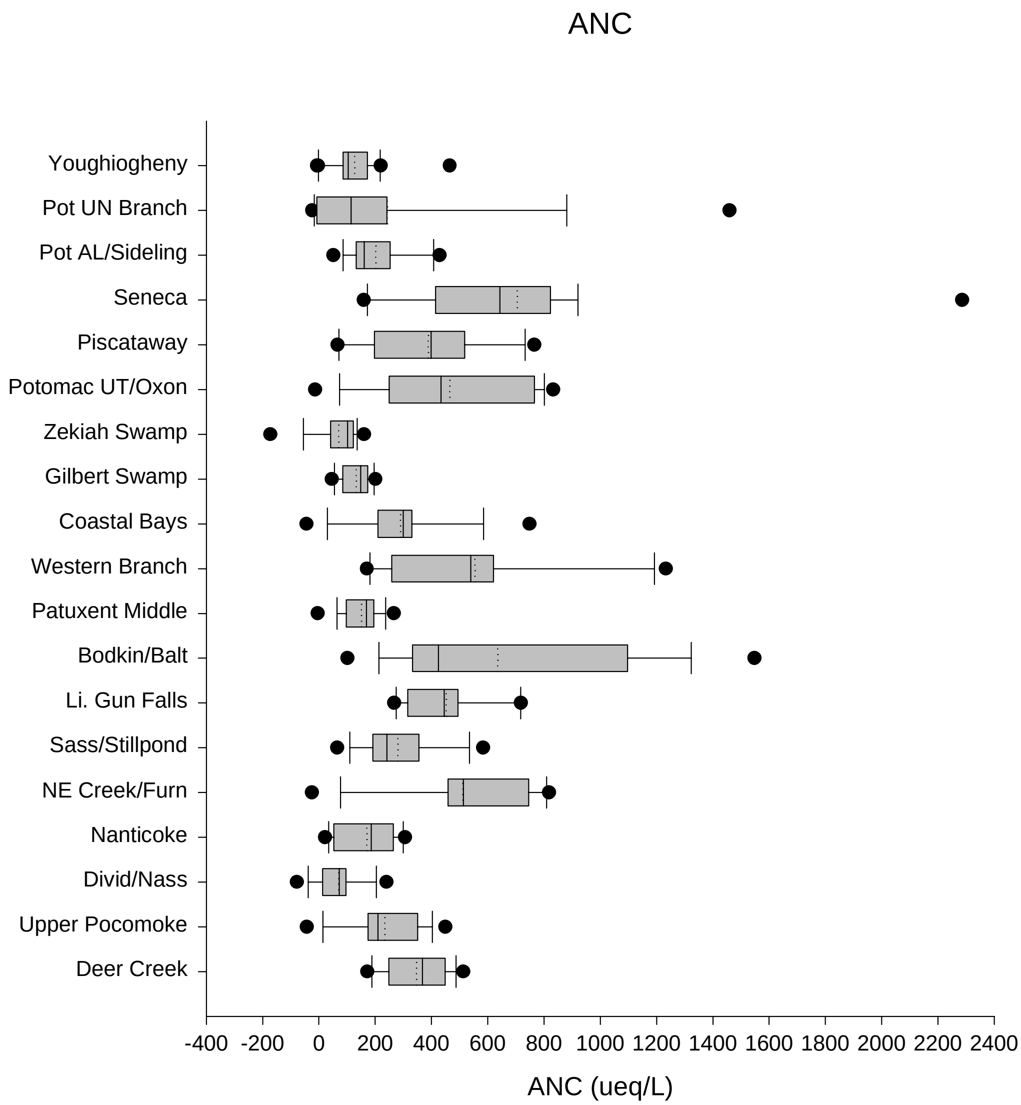


Figure 3-13. Distribution of Acid Neutralizing Capacity (ANC) values in μeq/L for the MBSS PSUs sampled in 2001

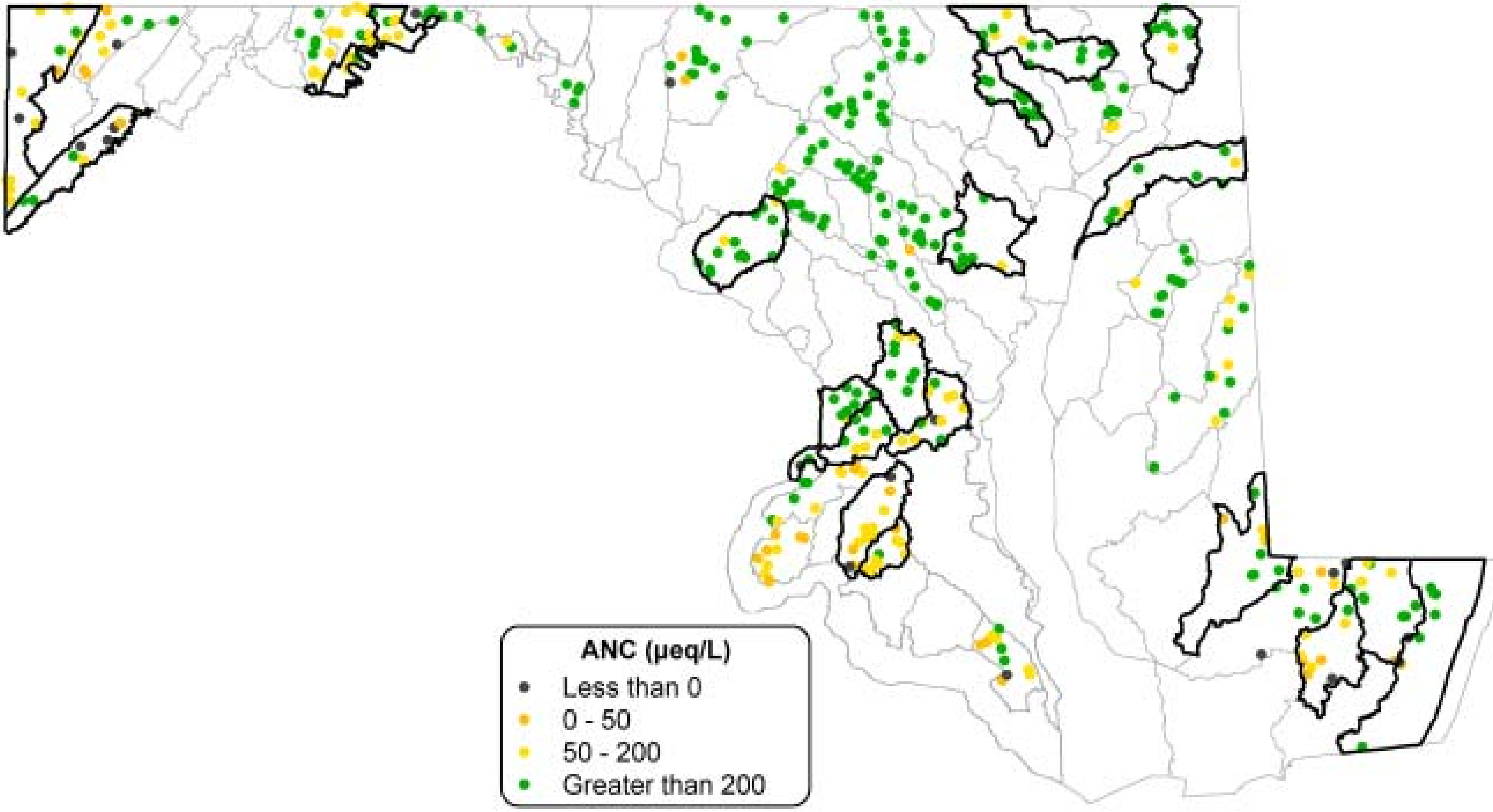


Figure 3-14. Distribution of Acid Neutralizing Capacity (ANC) values for the sites sampled in the 2000 and 2001 MBSS. PSUs sampled in 2001 have bold outlines.

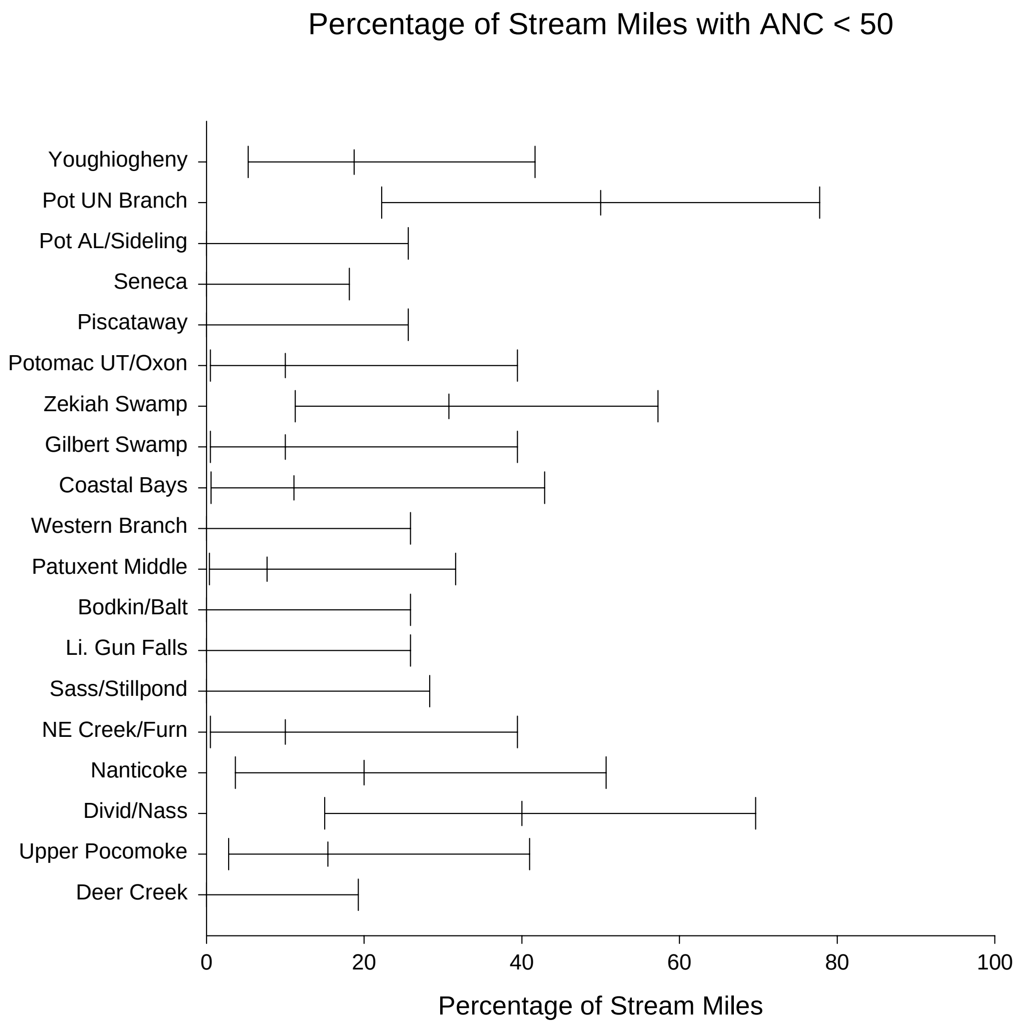


Figure 3-15. Percentage of stream miles with Acid Neutralizing Capacity (ANC) < 50 μeq/L for the MBSS PSUs sampled in 2001

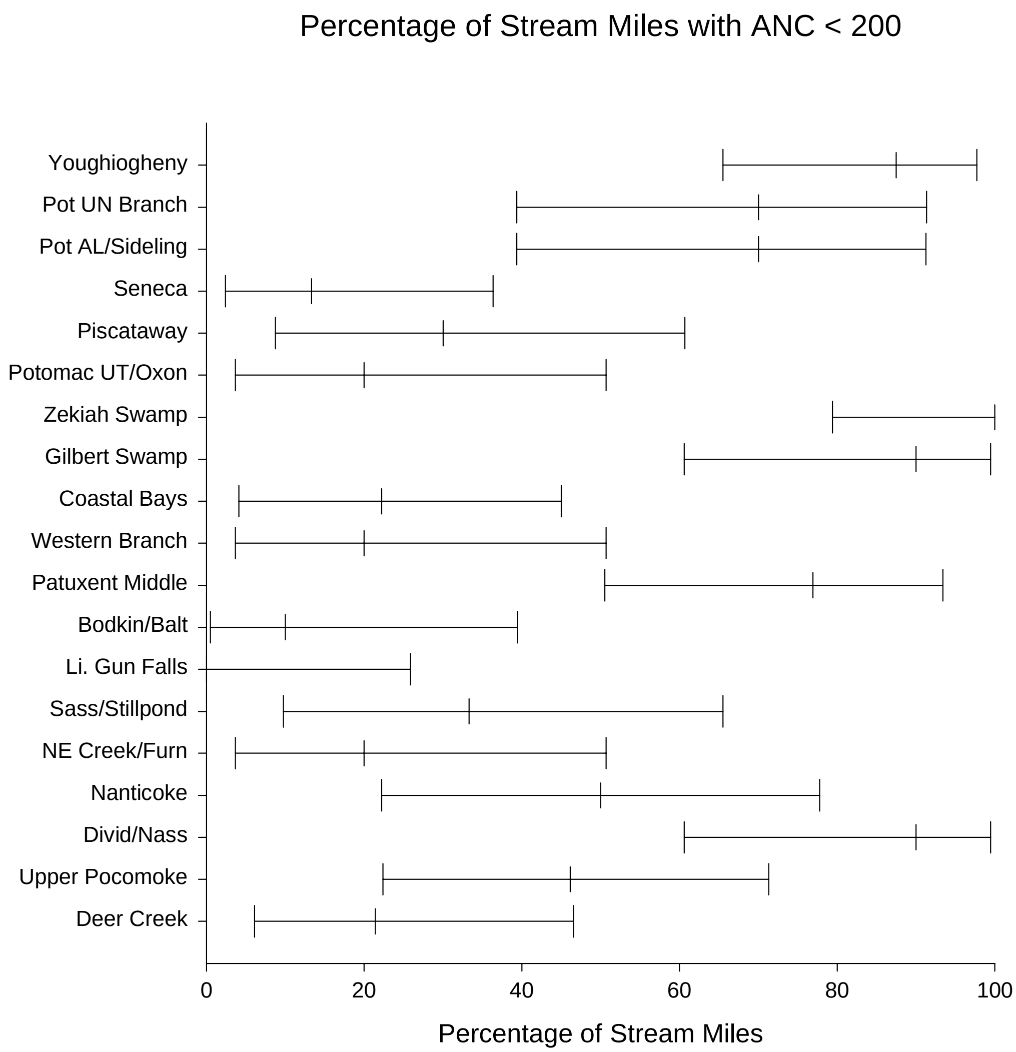


Figure 3-16. Percentage of stream miles with Acid Neutralizing Capacity (ANC) < 200 μeq/L for the MBSS PSUs sampled in 2001

MBSS sampling were analyzed to examine key physical habitat parameters that may affect biological communities.

3.4.1 Physical Habitat Index

A provisional PHI, developed using earlier MBSS data (Hall et al. 1999), was used to score sites sampled in 2001. Because of underlying differences in stream types, separate PHIs are applied in each of two geographic strata: the Coastal Plain and non-Coastal Plain. Four key physical habitat variables are common to both the Coastal Plain and the non-Coastal Plain indices: (1) instream habitat structure, (2) velocity/depth diversity, (3) embeddedness, and (4) aesthetic rating (trash rating). Two additional variables are important in the Coastal Plain – pool/glide/eddy quality and maximum depth. Two other variables are included in the non-Coastal Plain – riffle/run quality and number of rootwads in a stream reach.

Index scores are adjusted to a centile scale that rates each sample segment as follows:

- Scores of 72 to 100 are rated good
- Scores of 42 to 71.9 are rated fair
- Scores of 12 to 41.9 are rated poor
- Scores of 0 to 11.9 are rated very poor

Scores for MBSS 2001 sampling were computed by comparison with the same distributions of metric values that were used to develop the PHI. Thus indicator scores may be interpreted using the same narrative ratings employed in Round One.

Provisional PHI results by PSU are shown in Figure 3-17 and Appendix Table B-11. Scores varied widely within and among PSUs. The mean PHI fell into the range of good in two PSUs, both in western Maryland (Potomac River Upper North Branch and Youghiogheny River). Mean PHI was poor in one PSU (Bodkin Creek/Baltimore Harbor) and fair in the remaining 16 PSUs. The geographic distribution of mean PHI scores is shown on a statewide map (Figure 3-18).

Stream mile estimates of the occurrence of poor to very poor PHI scores suggest that physical habitat degradation is widespread (Figure 3-19, Appendix Table B-12). The greatest extent of low PHI scores was within Potomac River Allegany County/Sideling Hill Creek, where the 90% confidence interval predicted that 19 to 92% of stream miles were in poor to very poor condition. Many of the streams sampled in this PSU are small mountain streams that may be underrated by the provisional PHI.

The reader should note that an improved physical habitat index is now being developed for the MBSS. This revised index will be used to recalculate scores for all sites samples during 2000-2004.

3.4.2 Geomorphic Processes

Channelization can substantially alter the character of the stream. Historically, streams were commonly channelized to drain fields and to provide flood control. Today, streams in urban areas are often channelized to accommodate road-building or to drain stormwater from developed areas. When previously meandering streams are straightened, they may lose their natural connection to the floodplain, with significant adverse consequences for the stream ecosystem. For example, increased flows during storm events can lead to greater scouring, greater bank instability, and disruption of the natural pattern of riffle and pool habitats. At other times, decreased baseflows can result in stagnant ditches with substrates degraded by heavy sediment deposition.

MBSS 2001 results indicate that stream channelization is common in some Maryland watersheds, particularly in the Coastal Plain (Figure 3-20, Appendix Table B-13). The most widespread incidence of channelization was observed in Upper Pocomoke River (90% confidence interval: 51 to 93% of stream miles channelized), Coastal Bays PSU((35 to 90% of stream miles), Dividing Creek/Nassawango Creek, and Potomac River Upper Tidal/Oxon Creek (35 to 90% of stream miles in both PSUs).

Bank erosion is a common symptom of stream problems. Erosion within the stream channel, often associated with "flashy" flow regimes in highly urbanized watersheds, can scour banks and mobilize sediment. In fact, much of the sediment transported and deposited within the stream often originates from in-channel erosion rather than overland flow. Bank erosion can be a signal of channel instability (side-cutting) when a stream becomes entrenched (i.e., cannot reach its floodplain during high flow events). While the lack of streambank vegetation can contribute to bank erosion, severe erosion can in turn destabilize vegetation, causing even large trees to fall.

Moderate to severe bank erosion occurs commonly in Maryland streams, as seen in MBSS 2001 sampling results (Figure 3-21, Appendix Table B-14). Many watersheds had high occurrence of bank erosion. The greatest extent of moderate to severe bank erosion was estimated for Patuxent River Middle (90% confidence interval: 59 to 97% of stream miles) and Northeast River/Furnace Bay (45 to 96% of stream miles) PSUs.

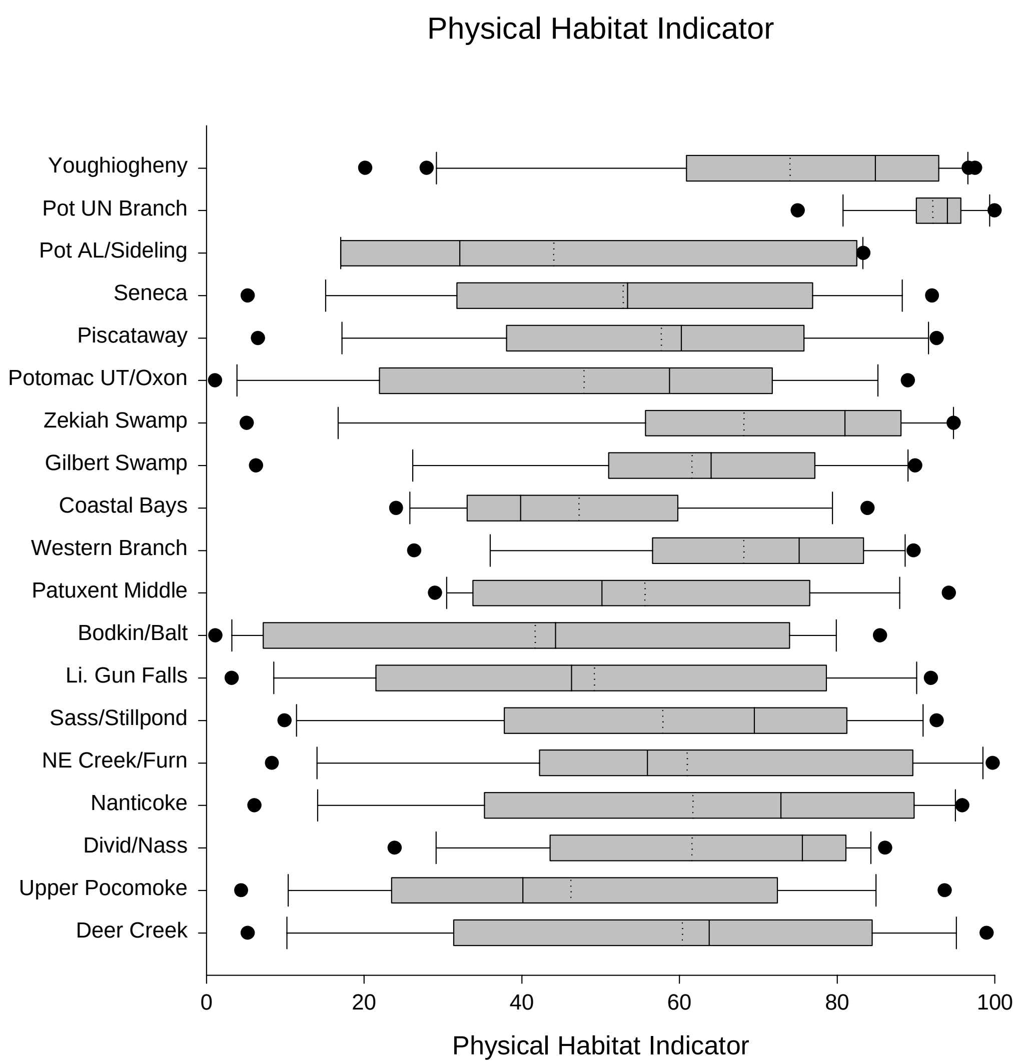


Figure 3-17. Distribution of Physical Habitat Indicator (PHI) scores for the MBSS PSUs sampled in 2001

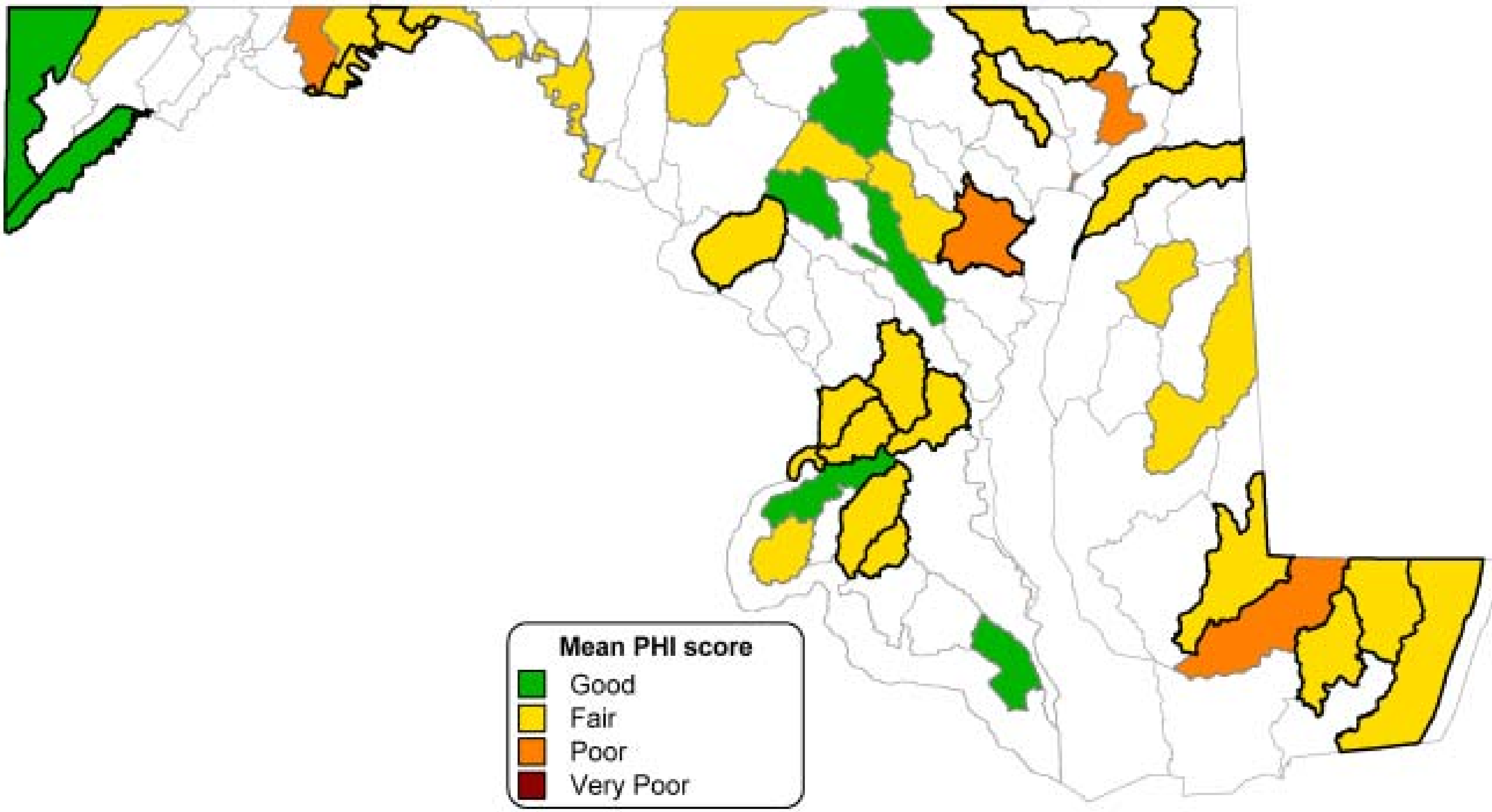


Figure 3-18. Mean Physical Habitat Indicator (PHI) scores for the MBSS PSUs sampled in 2000 and 2001. PSUs sampled in 2001 have bolder outlines than those sampled in 2000.

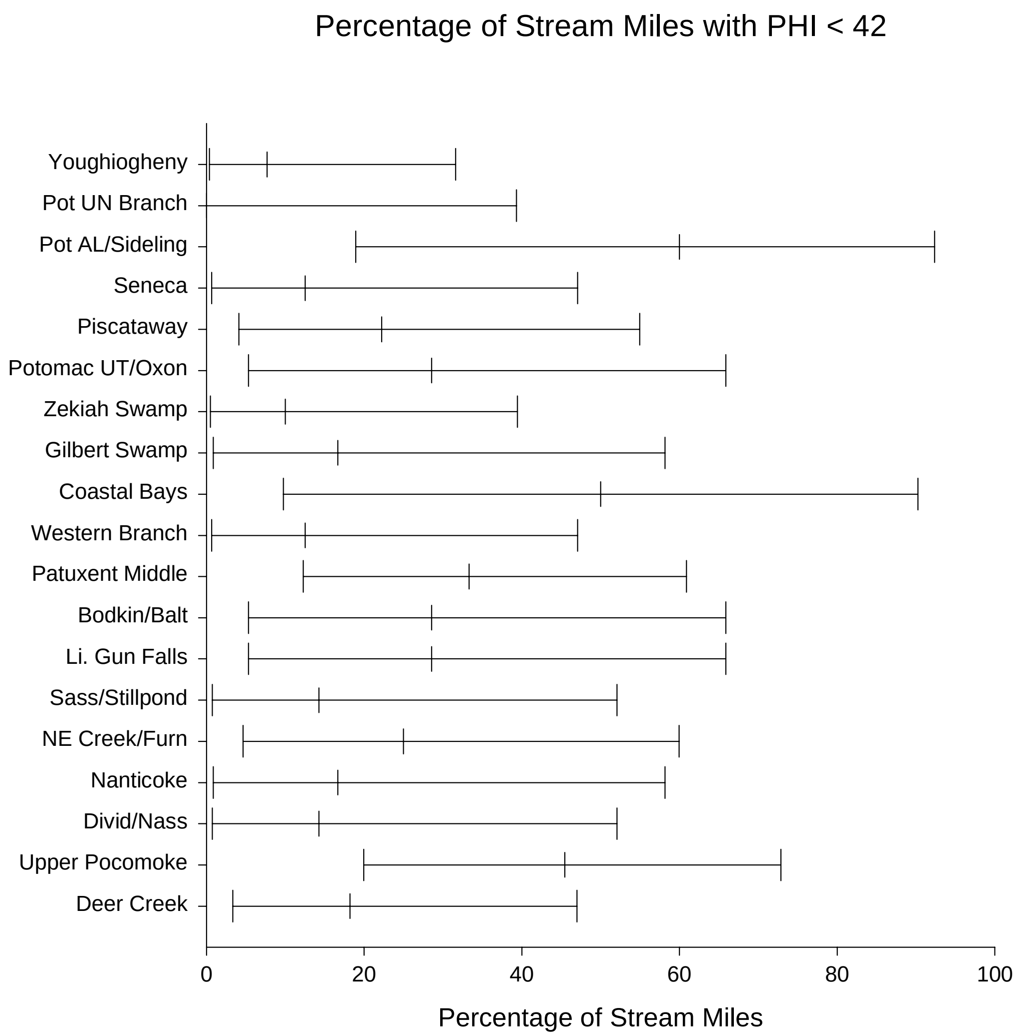


Figure 3-19. Percentage of stream miles with Physical Habitat Indicator (PHI) scores < 42 (poor to very poor) for the MBSS PSUs sampled in 2001

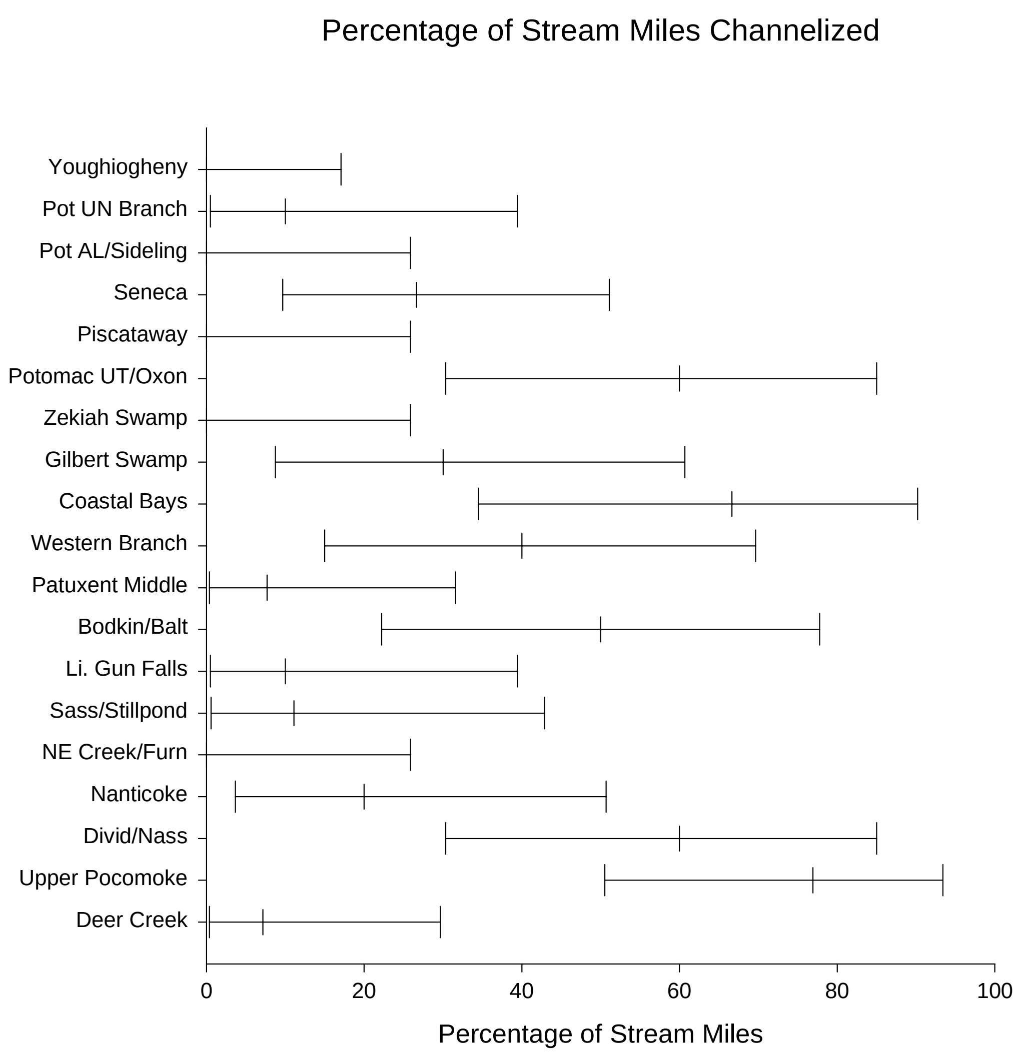


Figure 3-20. Percentage of stream miles channelized for the MBSS PSUs sampled in 2001

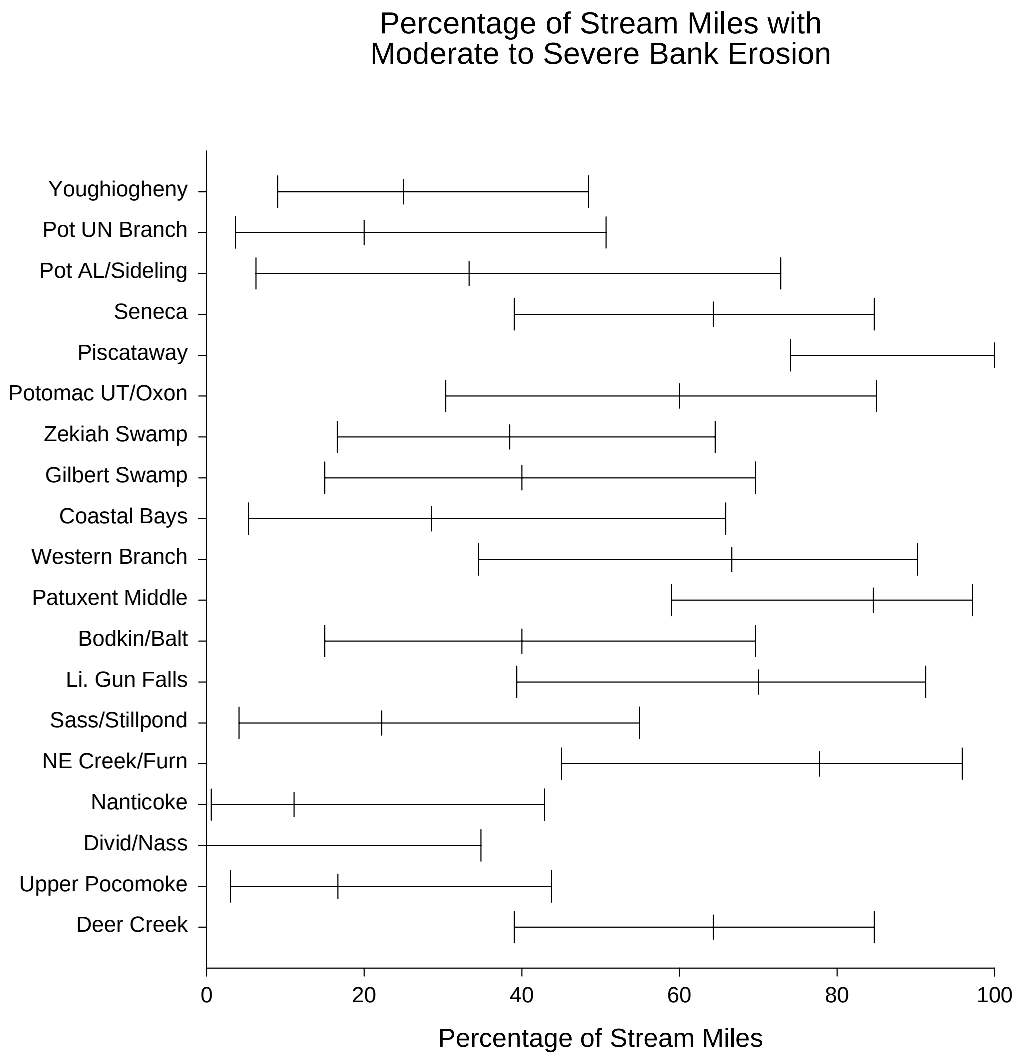


Figure 3-21. Percentage of stream miles with moderate to severe bank erosion for the MBSS PSUs sampled in 2001

Within each 75-meter segment sampled, field estimates of the amount of eroded bank area were made. Moderate to severe erosion was included in analysis. Mean values be PSU were used to estimate the extent of eroded area (square meters) per stream mile. The highest values were in Patuxent River Middle, Northeast River/Furnace Bay, Piscataway Creek, Seneca Creek, and Western Branch PSUs. Per-mile areas were then used to project the total surface area of bare, eroded bank in each PSU (Table 3-3). Combined, the eroded bank area in these 19 PSUs totals more than 330 acres.

Significant deposition of gravel and fine sediments can lead to mid-channel bar formation. Although some formation of bars is natural, more severe bar formation can signal channel instability related to bank erosion and altered flow regimes. Such streams typically have poor habitat for stream biota because substrate shifts with each high flow event. Sediments can become resuspended, increasing turbidity.

Exacerbated bar formation was observed in most watersheds sampled in 2001 (Figure 3-22, Appendix Table B-15). Estimates of the percentage of stream miles experiencing moderate to severe bar formation were highest in Piscataway Creek (90% confidence interval: 71 to 100% of stream miles), Patuxent River Middle (59 to 97% of stream miles), and Potomac River Upper Tidal/Oxon Creek (39 to 91% of stream miles).

3.4.3 Vegetated Riparian Buffers and Woody Debris

A complete characterization of stream habitat goes beyond in-channel measures and includes the riparian zone adjacent to the stream. The effectiveness of the riparian buffer in mitigating nutrient loading and providing other benefits to the stream varies with the type and amount of riparian vegetation. MBSS records data on both the type and extent of local riparian vegetation, estimated as the functional width of the riparian buffer along each side of the 75-m sample segment.

Lack of riparian vegetation on at least one stream bank was observed within nine of 19 PSUs sampled. Data were used to estimate the percentage of stream miles lacking riparian buffer vegetation on at least one bank (Figure 3-23) or on both banks (Figure 3-24) (Appendix Tables B-16 and B-17).

Table 3-3. Eroded streambank area by stream miles and total eroded streambank area per PSU sampled in MBSS 2001

PSU	Mean Eroded Area (m^2)	Mean Eroded Area (m^2) Per Mile	Number of Stream Miles in PSU	Total Eroded Area in PSU (acres)
Assawoman/Chincoteague/Newport/Sinepuxent/Isle of Wight Bays	32.2	691.5	74.1	12.8
Bodkin Creek/Baltimore Harbor	24.0	515.0	44.9	5.8
Deer Creek	33.6	720.4	194.6	35.1
Dividing Creek/Nassawango Creek	0.0	0.0	99.1	0.0
Gilbert Swamp	21.0	450.6	58.1	6.6
Little Gunpowder Falls	46.0	987.1	73.2	18.1
Nanticoke River	8.0	171.7	68.2	2.9
Northeast River/Furnace Bay	63.0	1351.9	82.9	28.0
Patuxent River Middle	86.9	1865.3	98.9	46.1
Piscataway Creek	58.0	1244.6	70.5	21.9
Potomac River Allegany County/Sideling Hill Creek	10.0	214.6	78.0	4.2
Potomac River Upper North Branch	10.0	214.6	98.9	5.3
Potomac River Upper Tidal/Oxon Creek	41.0	879.8	50.0	11.0
Sassafras River/Stillpond-Fairlee	22.2	476.9	75.2	9.0
Seneca Creek	49.3	1058.7	188.9	50.0
Upper Pocomoke River	4.6	99.0	116.7	2.9
Western Branch	53.0	1137.3	131.5	37.4
Youghiogheny River	12.5	268.2	228.0	15.3
Zekiah Swamp	25.4	544.7	145.4	19.8

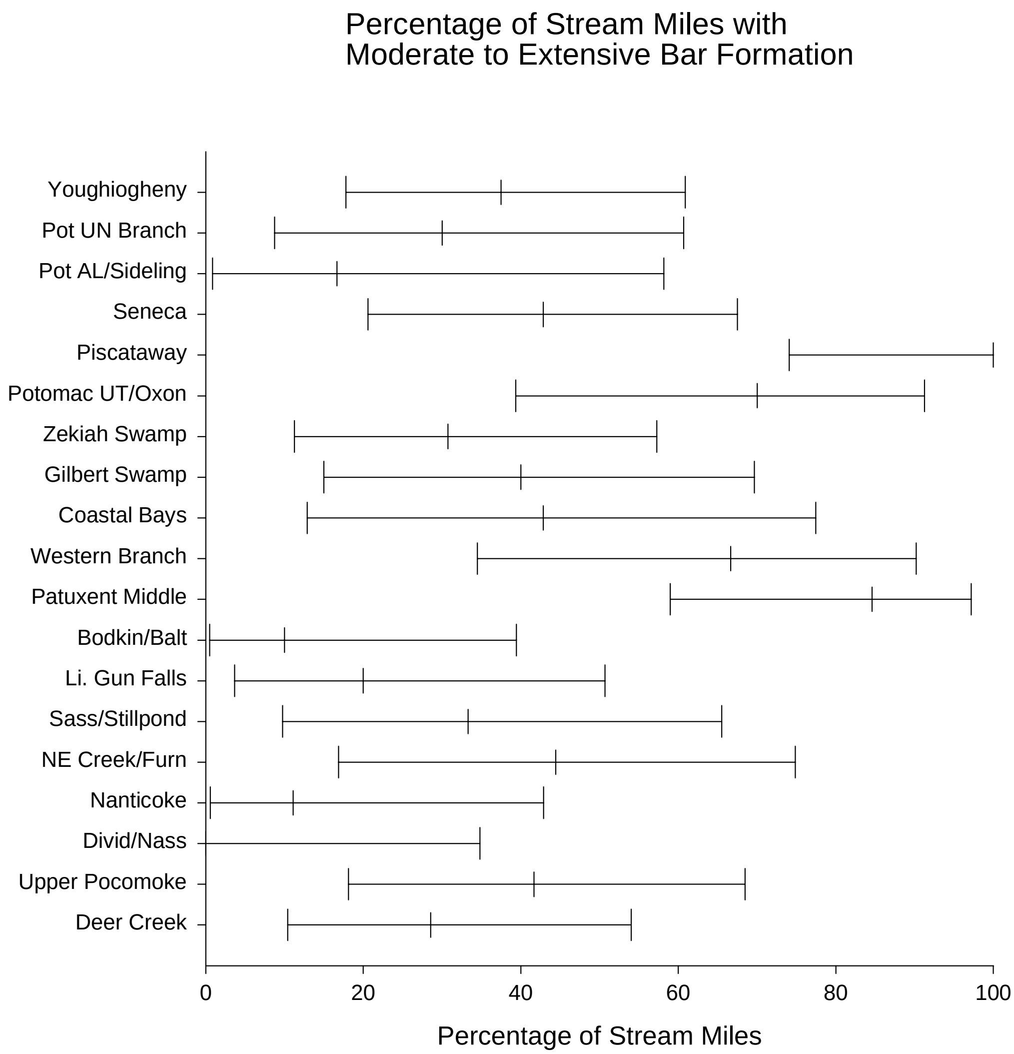


Figure 3-22. Percentage of stream miles with moderate to extensive bar formation for the MBSS PSUs sampled in 2001

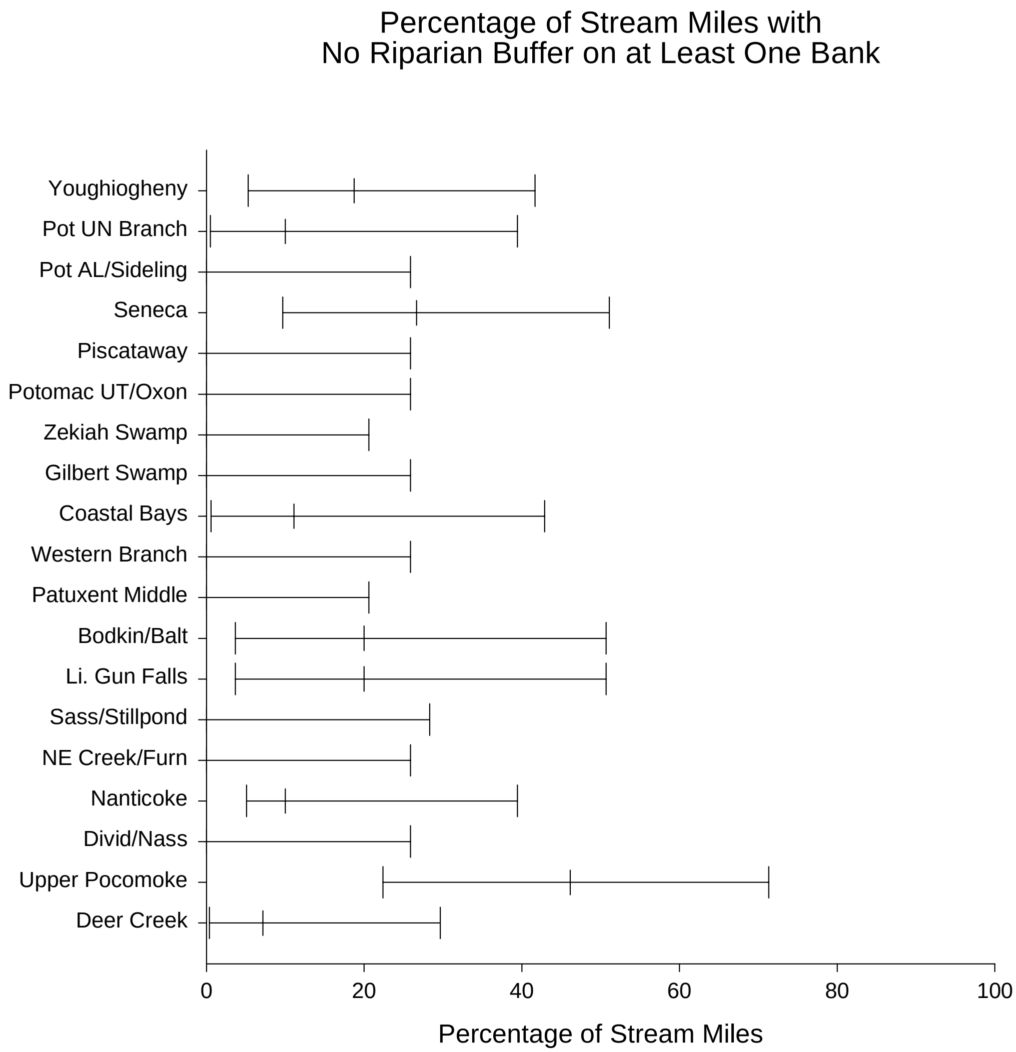


Figure 3-23. Percentage of stream miles with no riparian buffer on at least one bank for the MBSS PSUs sampled in 2001

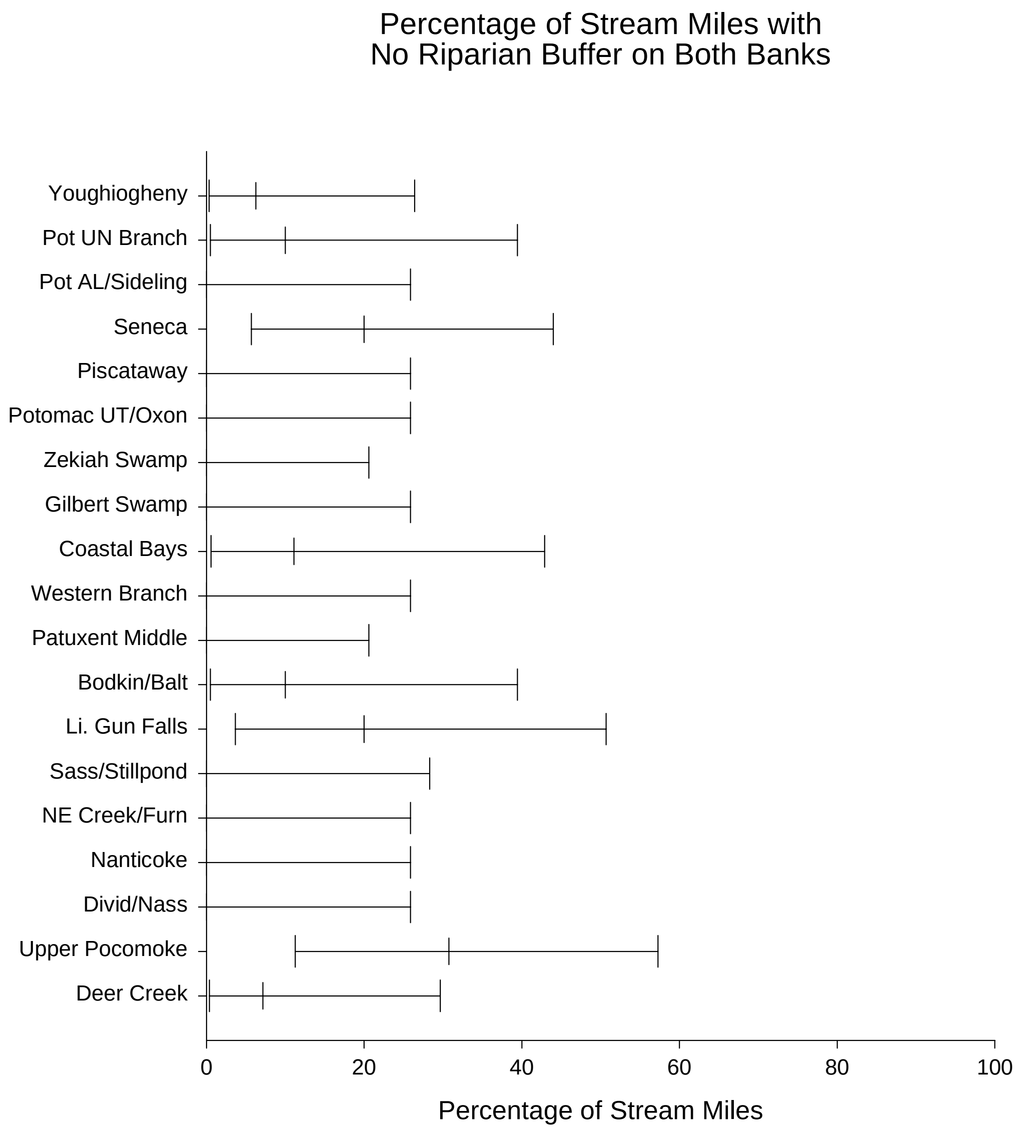


Figure 3-24. Percentage of stream miles with no riparian buffer on both banks for the MBSS PSUs sampled in 2001

The presence of non-native plant species is another indication of the integrity of the riparian plant community. Invasive species such as multiflora rose, mile-a-minute, and Japanese honeysuckle can crowd out native plants. Most watersheds appeared affected by the presence of exotic plants (Figure 3-25, Appendix Table B-18). In cases of high abundance along streams, these species can prevent natural regeneration and/or growth of intentionally planted trees and are thus a threat to buffer reestablishment.

Rootwads and other types of woody debris provide habitat, cover, and shade for a variety of stream biota. When riparian forests are removed, this important source of woody debris is lost. To assess the availability of this key habitat feature, the numbers of rootwads and other woody debris within each 75-m segment were recorded by MBSS field crews. The total number of instream pieces of woody debris and rootwads was substantially higher in Zekiah Swamp (Figure 3-26, Appendix Table B-19), due primarily to one site where 118 total instream woody debris and rootwads were counted. Along with wood found within the wetted width of the stream itself, other in-channel (but dewatered) woody debris is a potential future source of habitat. Separate results for instream, dewatered, and total counts of woody debris and rootwads are shown in Figures 3-27 to 3-32 (Appendix Tables B-20 to B-25). The amount of rootwads and large woody debris in Maryland streams is expected to grow over time as forestry professionals continue to recognize the critical role that wood plays in stream health.

3.4.4 Temperature

During 2001, MBSS deployed continuous reading temperature loggers at more than 200 sites. The long-term goal is to use temperature data to (1) better classify and characterize coldwater streams and (2) identify streams stressed by temperature changes, such as spikes from rapid inputs of warm water running off impervious surfaces during summer storms. Data were recorded at 20-minute intervals with loggers set to record the highest value observed during each 20 minute interval. Initial data analyses consisted of a quality assurance review (to exclude sites where temp loggers were lost or not submerged in the stream during low flow periods), establishment of a consistent period of record, and computation of several summary indicators. Indicators were calculated for 175 sites where the data record was complete. Generally the period of record considered was June 1 to August 15, although some exceptions were made (e.g., to include sites where monitoring began between June 1 and 15).

Summary indicators included:

- Mean and an average daily temperature
- Mean minimum and maximum daily temperatures
- Absolute maximum temperature
- 95th percentile temperature
- Percentage of readings exceeding thresholds in state water quality standards

Maryland water quality standards for temperature state that the maximum temperature may not exceed 32 °C (90 °F) in most waters, 20 °C (68 °F) in Class III Natural Trout Waters, or 23.9 °C (75 °F) in Class IV Recreational Trout Waters (COMAR 1995)Sthe three horizontal lines in Figures 3-33 and 3-34.

Results for sites monitored in 2001 are listed in Appendix C. Among all sites assessed, mean average daily temperatures ranged from 12.8 to 24.8 °C, indicating the presence of both coldwater and warmwater sites in the data set. The lowest mean daily minimum was 11.5 °C at a third-order site in Seneca Creek watershed. Future analyses of data from coldwater streams will assist in interpretation of IBI scores and will contribute to development of a fish IBI tailored to these systems. Trout and several non-game species require cool to cold waters. For example, EPA criteria for growth and survival of brook trout (Maryland's only native salmonid) are maximum weekly means of 19 and 24 °C. Research has found a still lower temperature of 14.4 °C as the maximum temperature for juvenile growth of brook trout (EPA 1976 and McCormick et al. 1972, as cited in Eaton et al. 1995).

Fourteen sites had occasional readings above 32 °C, including one in Dividing Creek/Nassawango Creek where the temperature exceeded 32 °C more than 2% of the time. A systematic review of whether any Class III or IV streams exceeded standards would require examination of site data by stream class and was beyond the scope of this report.

Examples of daily temperature data from coldwater and warmwater sites are shown in Figures 3-33 and 3-34.

3.5 NUTRIENTS AND OTHER WATER CHEMISTRY

Nutrients such as nitrogen and phosphorus are important for life in all aquatic systems. In the absence of human influence, streams contain relatively low background levels of nutrients that are essential to the survival of the aquatic

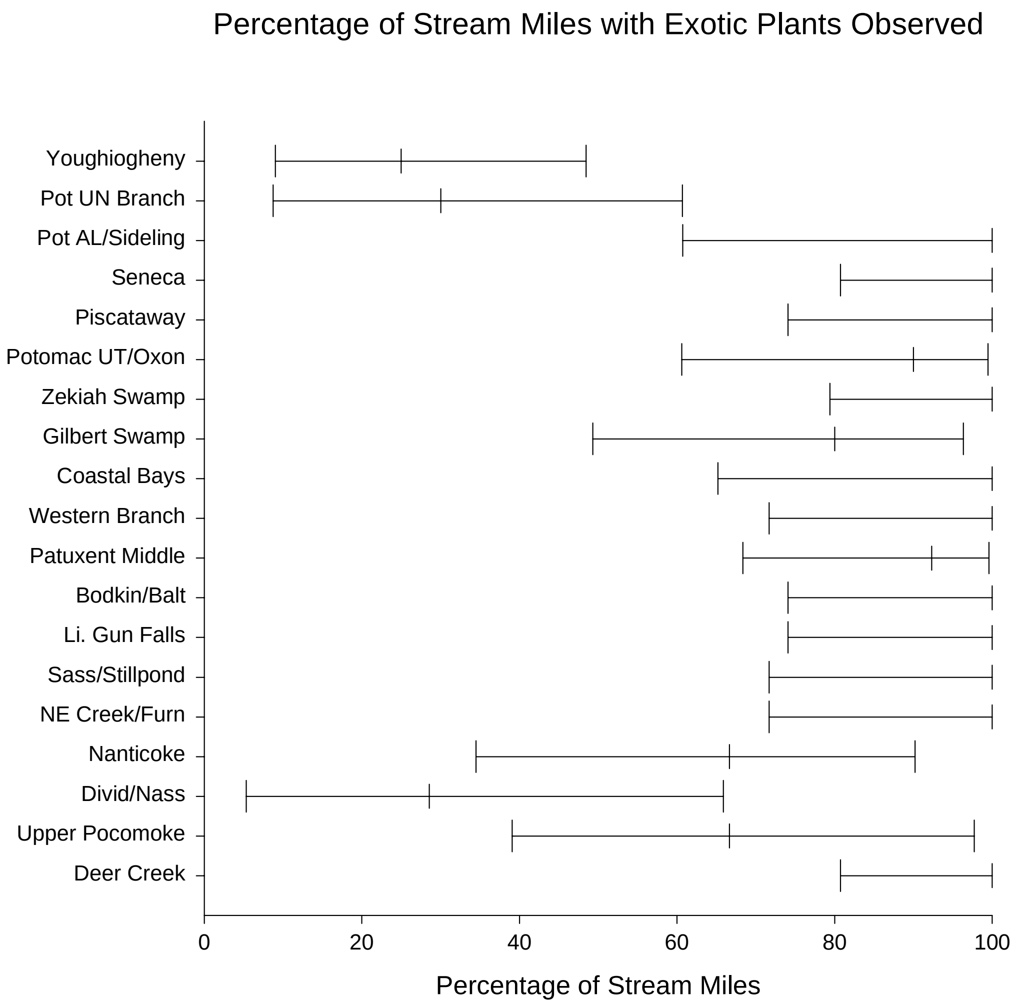


Figure 3-25. Percentage of stream miles with exotic plants observed for the MBSS PSUs sampled in 2001

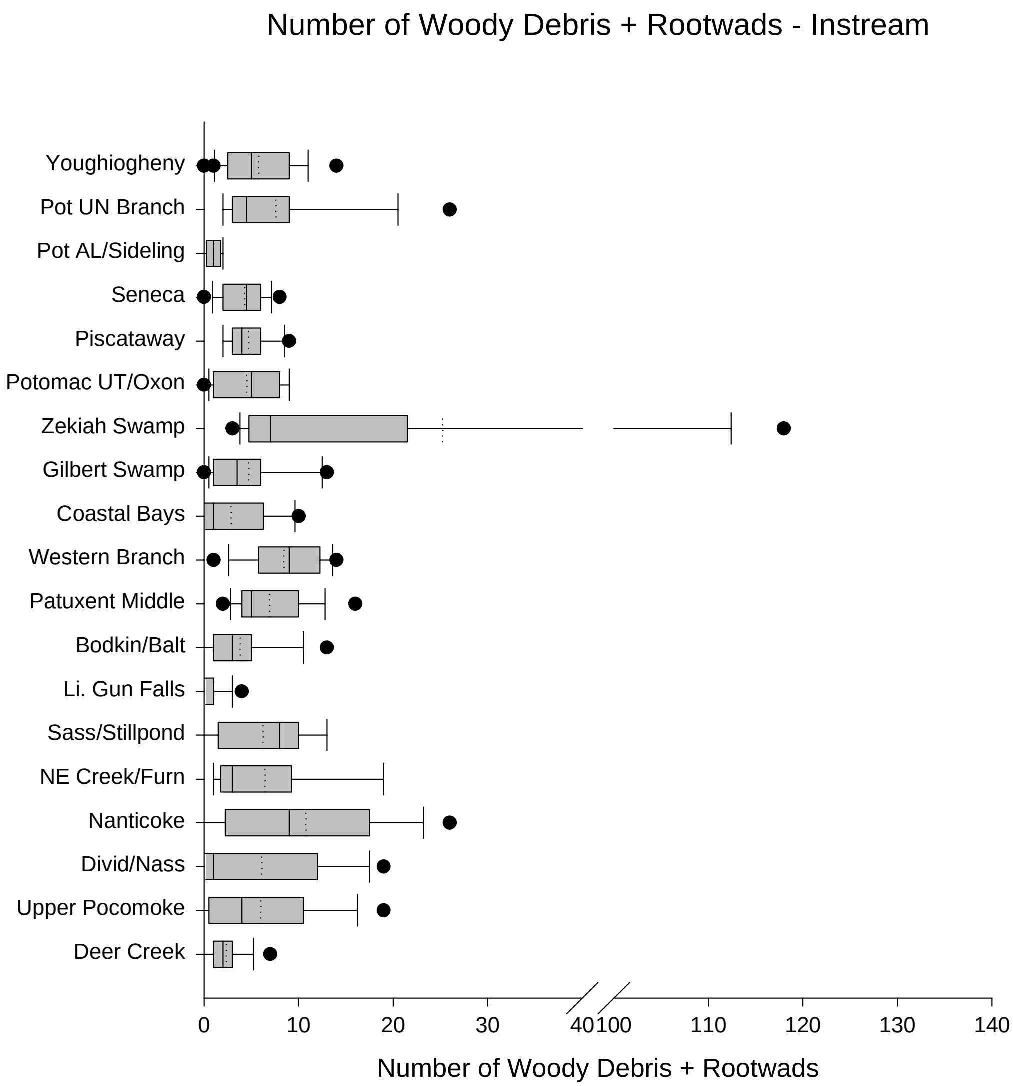


Figure 3-26. Distribution of the sum of the total number of instream woody debris and the total number of instream rootwads for the MBSS PSUs sampled in 2001

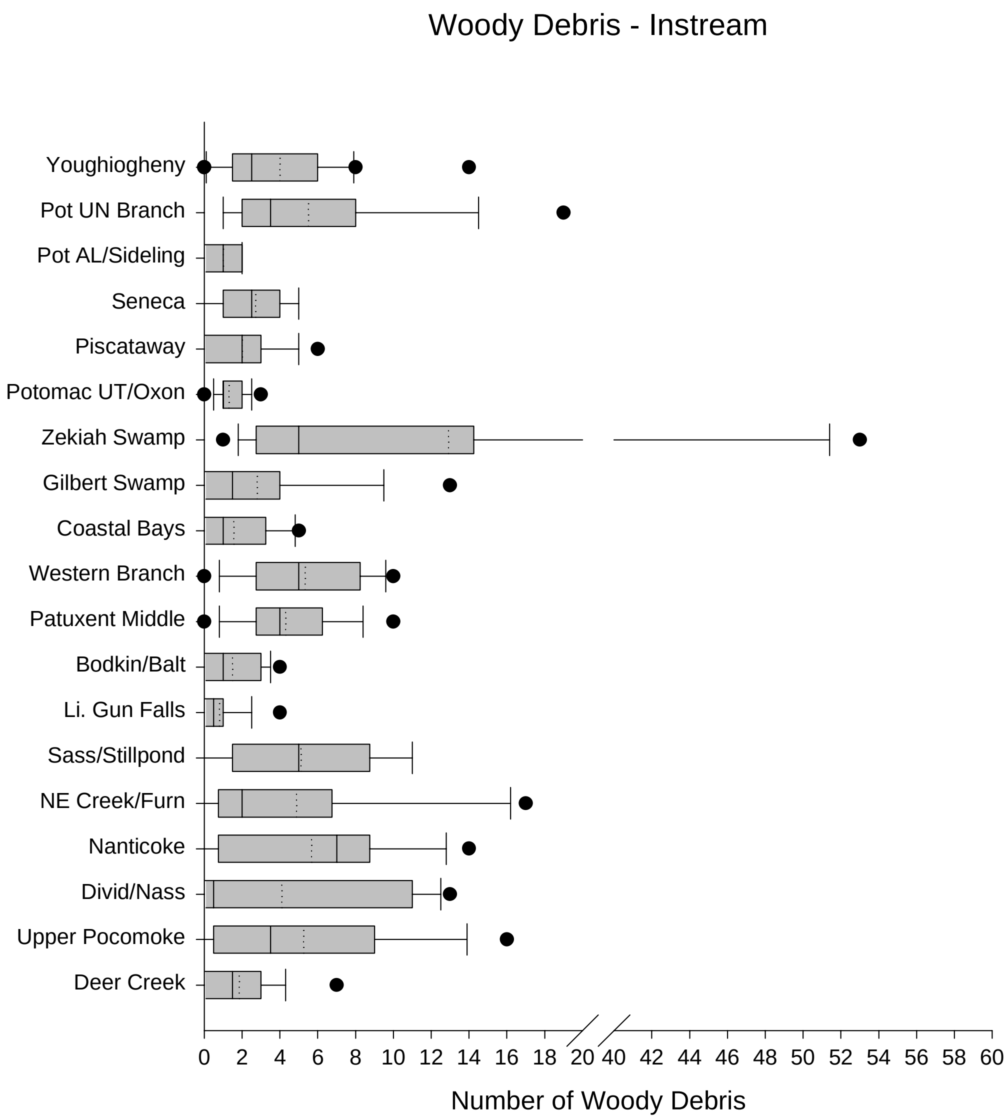


Figure 3-27. Distribution of the number of instream woody debris for the MBSS PSUs sampled in 2001

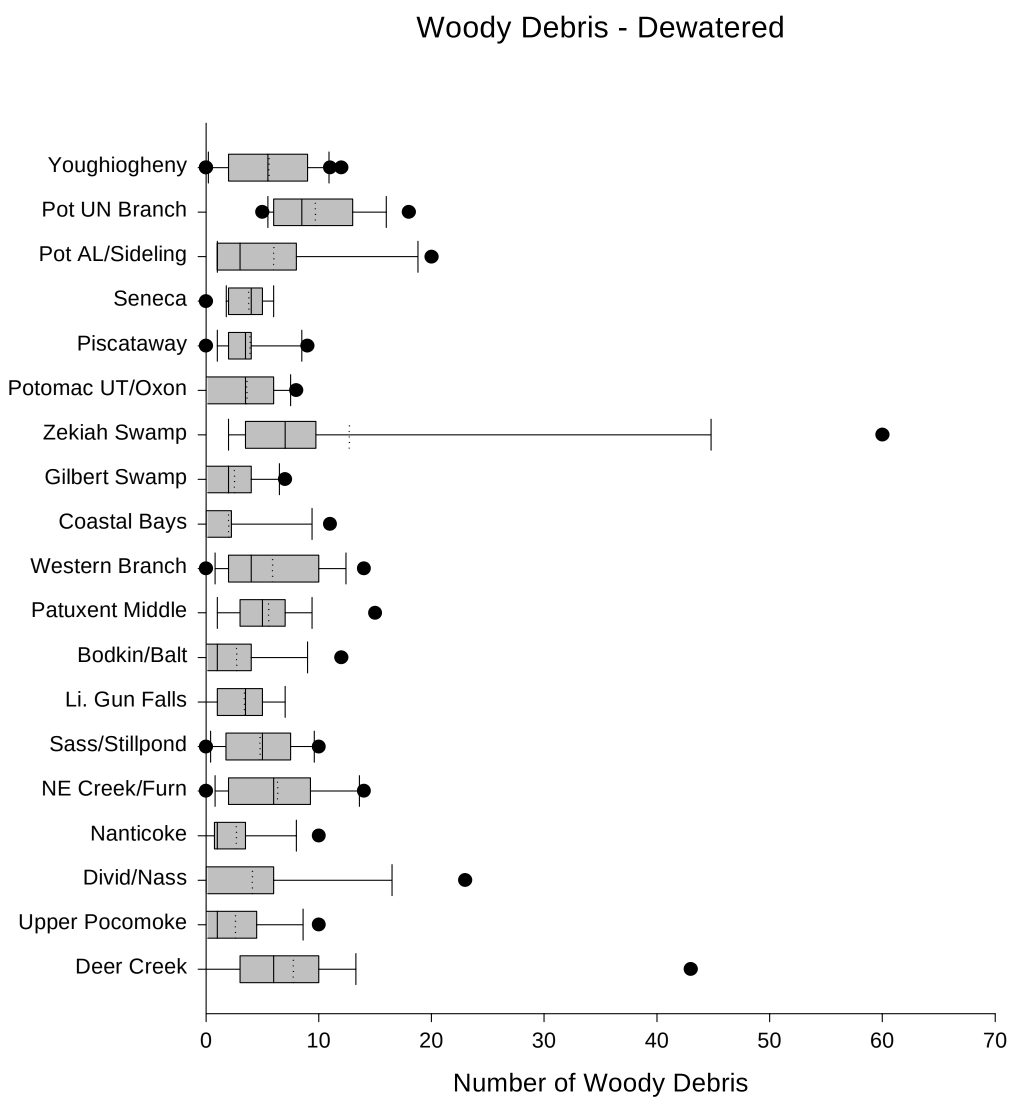


Figure 3-28. Distribution of the number of dewatered woody debris for the MBSS PSUs sampled in 2001

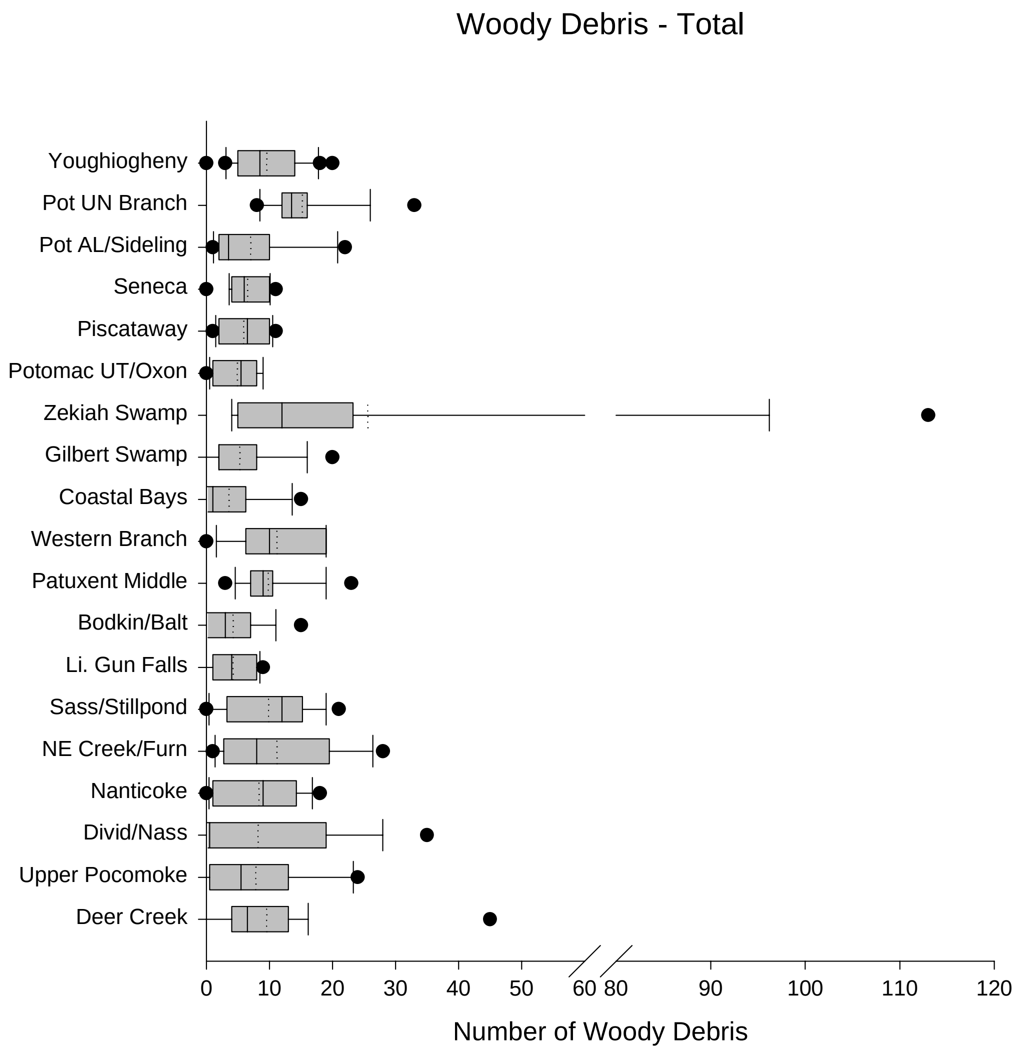


Figure 3-29. Distribution of the total number of woody debris (instream and dewatered) for the MBSS PSUs sampled in 2001

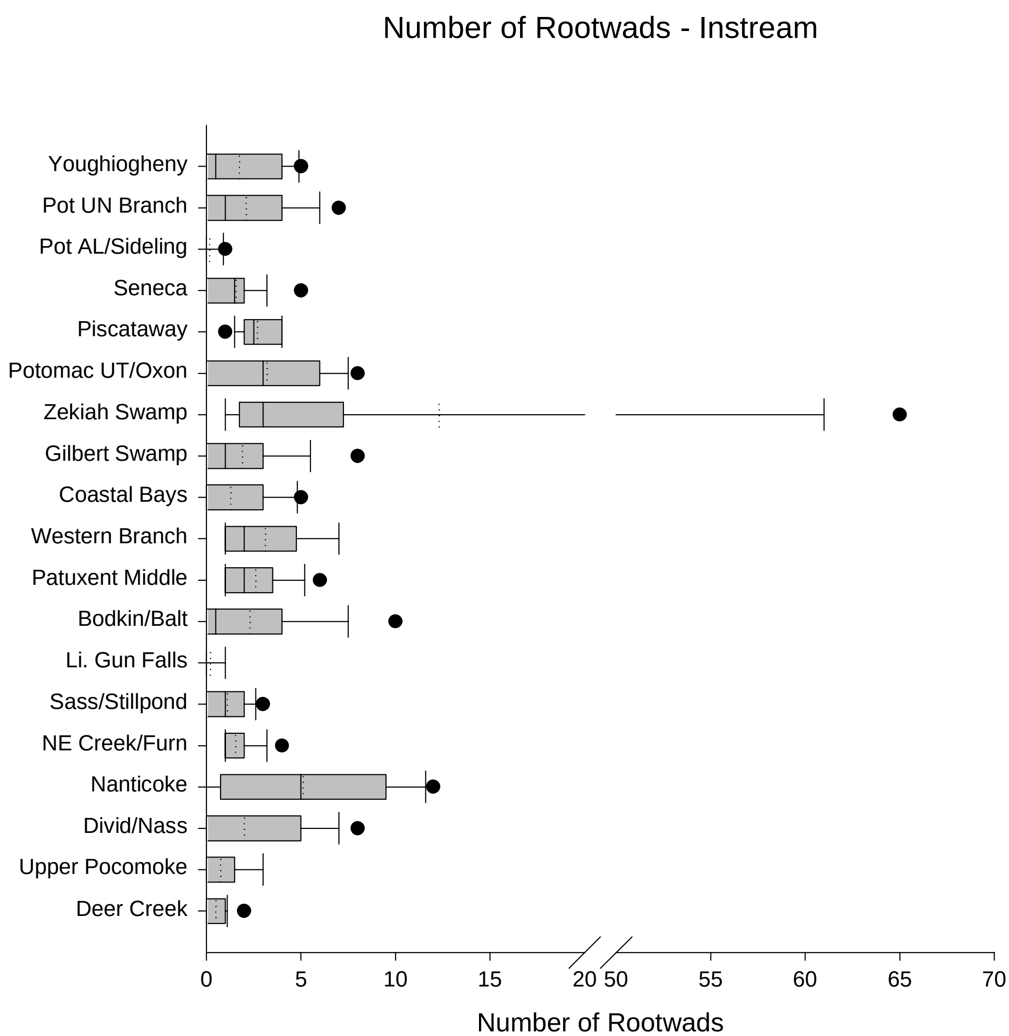


Figure 3-30. Distribution of the number of instream rootwads for the MBSS PSUs sampled in 2001

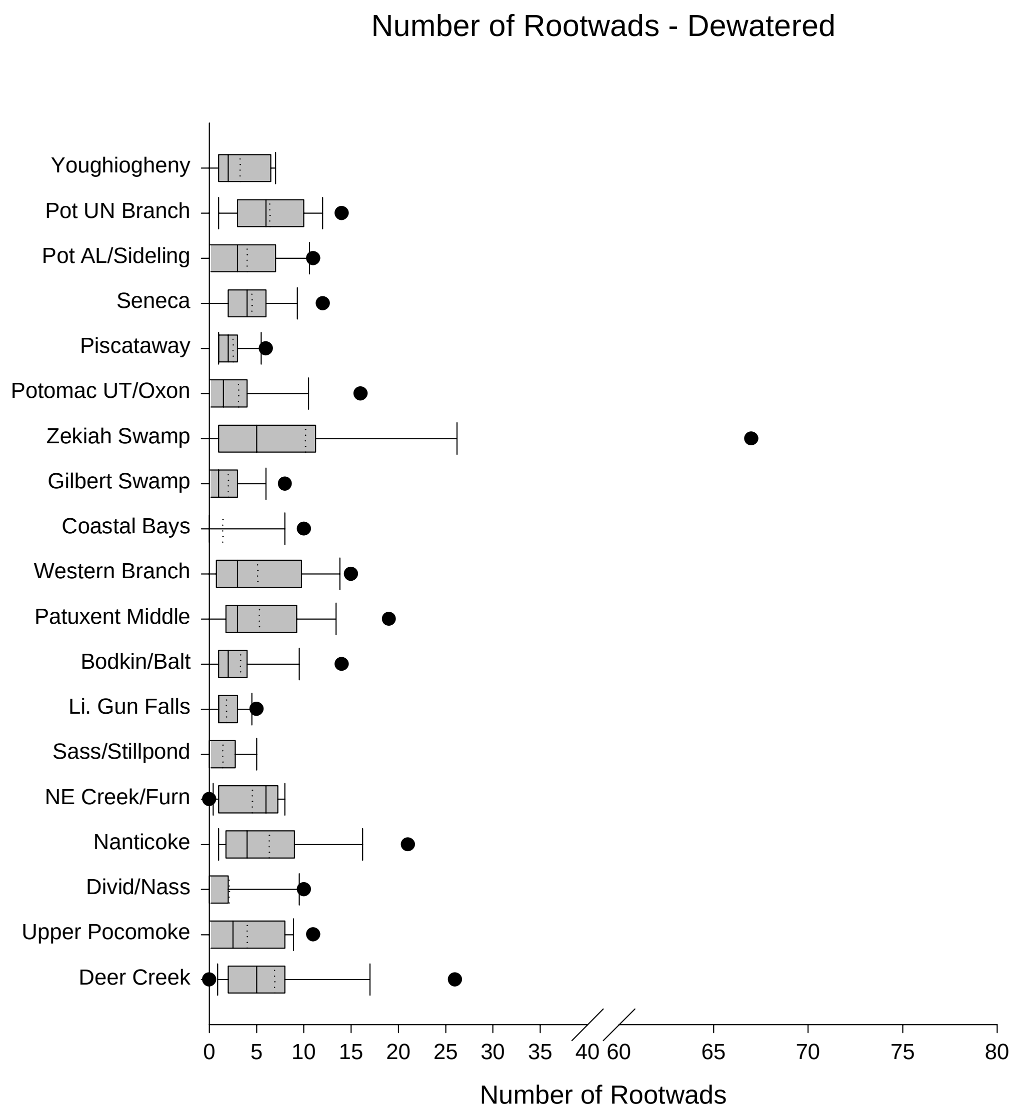


Figure 3-31. Distribution of the number of dewatered rootwads for the MBSS PSUs sampled in 2001

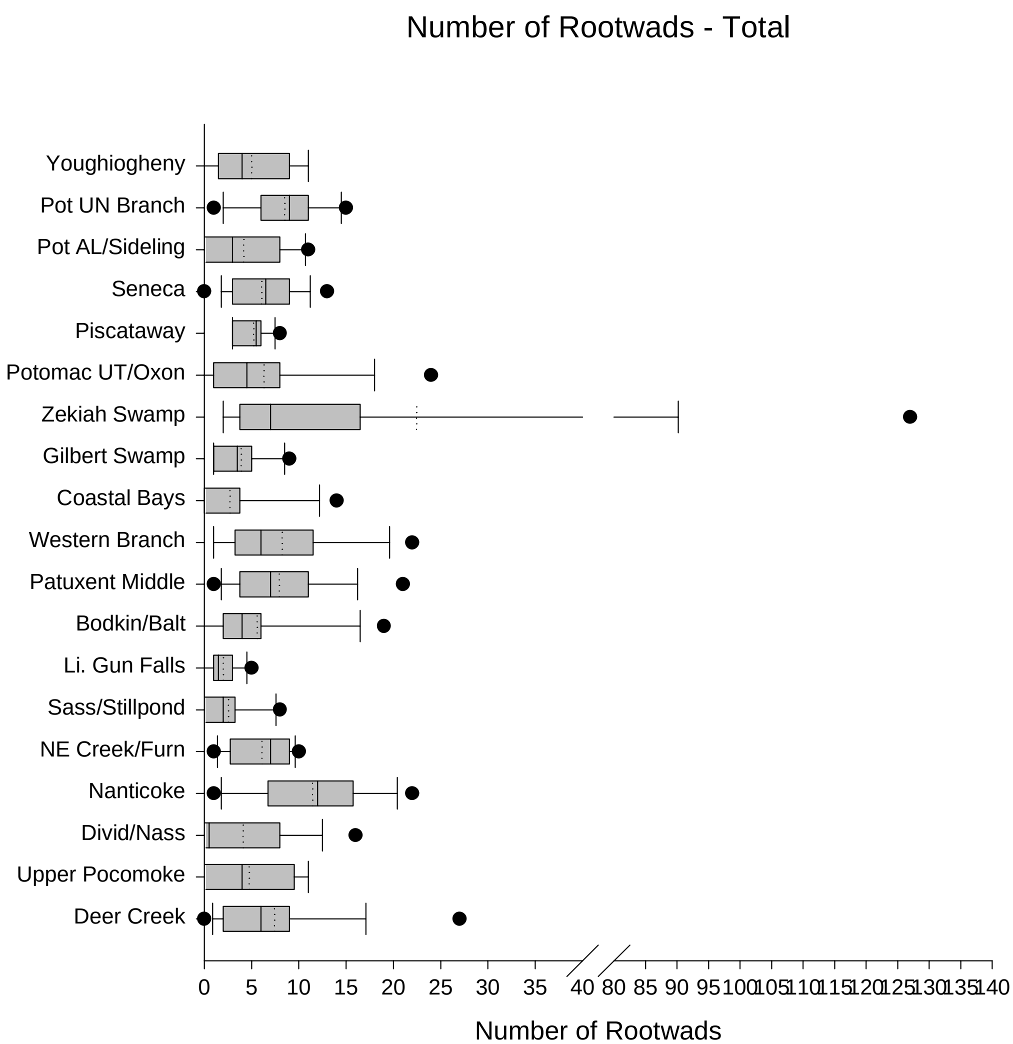


Figure 3-32. Distribution of the total number of rootwads (instream and dewatered) for the MBSS PSUs sampled in 2001

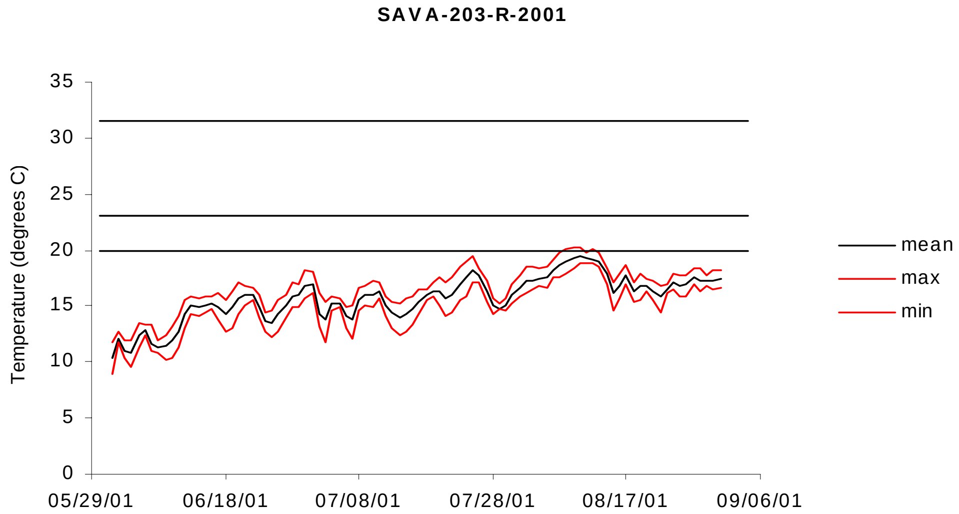


Figure 3-33. Mean, minimum and maximum daily temperatures (degrees Celsius) for a coldwater stream sampled in the MBSS 2001, site SAVA-203-R-2001. Period of record was from June 1, 2001 to August 31, 2001.

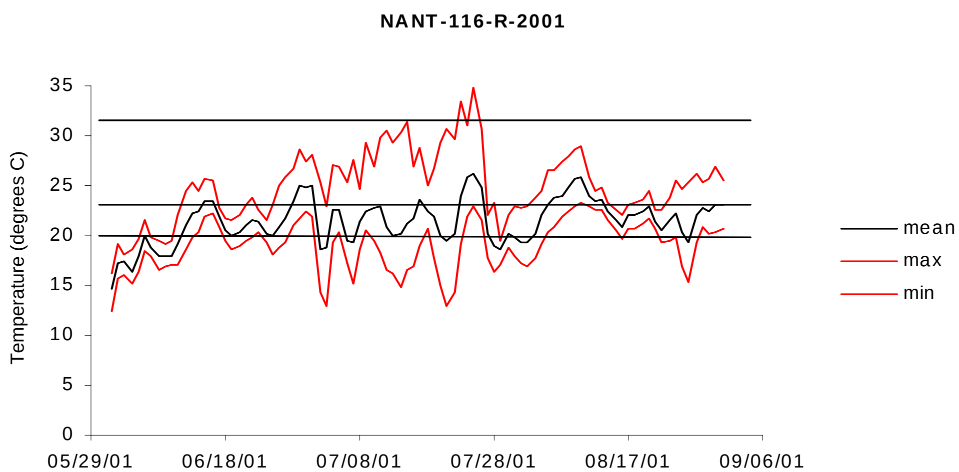


Figure 3-34. Mean, minimum, and maximum daily temperatures (degrees Celsius) for a warmwater stream sampled in the MBSS 2001, site NANT-116-R-2001. Period of record was from June 1, 2001 to August 31, 2001.

plants and animals in that system. However, during the last several hundred years, the amount of nutrients transported to many stream systems has increased greatly as a result of anthropogenic influences such as agricultural runoff, wastewater discharge, urban/suburban nonpoint sources, and atmospheric deposition.

Excessive nitrogen and phosphorus loading may lead to eutrophication, particularly in downstream estuaries. Eutrophication often decreases the level of dissolved oxygen available to aquatic organisms. Prolonged exposure to low dissolved oxygen values can suffocate biota or lead to reduced condition. Increased nutrient loads are also thought to be harmful to humans by causing toxic algal blooms and contributing to outbreaks of toxic organisms such as *Pfiesteria piscicida*. In Maryland, concern for nutrient loadings to the Chesapeake Bay has drawn attention to the amounts of materials transported from throughout the watershed by stream tributaries.

The Survey provides a large dataset that can be used to assess nutrient concentrations under spring baseflow conditions. Although a full understanding of nutrient loadings also requires data collected over time, (i.e., taken over multiple years and seasons particularly during high-flow events) the Survey's water chemistry results provide extensive spatial coverage and a useful picture of where nutrient levels are high.

In addition to various nitrogen and phosphorus measures, the Survey assesses dissolved oxygen (DO), turbidity, sulfate (as an indicator of AMD), chloride (an indicator of general anthropogenic disturbance), and dissolved organic carbon (DOC). Key results are summarized below. Where possible, results are compared with threshold levels likely to indicate human influence (Roth et al. 1999 and R. Morgan, personal communication, 2001). To illustrate the potential degree of human impact, many figures referenced below show data in relation to these thresholds, depicted in graphs by a vertical dotted line.

3.5.1 Nutrients

Total nitrogen (the sum of total dissolved and particulate nitrogen concentrations) tended to be highest in Central Maryland and the Eastern Shore (Figures 3-35 and 3-36). In general, nitrate nitrogen (Figure 3-37) made up the largest fraction of total nitrogen. Nitrite nitrogen was higher in Central Maryland and the Eastern Shore than elsewhere in Maryland (Figure 3-38). As expected, ammonia, often associated with agricultural uses and animal wastes, was highest on the Eastern Shore, especially in Sassafras River/Stillpond Fairlee (Figure 3-39). Appendix Tables B-26 to B-29 detail these results by PSU.

Nitrate nitrogen concentrations greater than 1 mg/l are commonly considered to indicate anthropogenic influence. This is several times higher than the concentration of 0.08 mg/l recently reported for streams in undisturbed watersheds (Clark et al. 2000). Mean nitrate nitrogen concentrations in 10 of 19 PSUs exceeded 1 mg/l. Estimates of the percentage of stream miles with nitrate nitrogen > 1 mg/l by PSU dramatically illustrate the extent of elevated nitrate levels, especially in Central Maryland (Figure 3-40, Appendix Table B-30). In several PSUs, nearly 100% of stream miles have high nitrate nitrogen concentrations.

Total phosphorus (the sum of total dissolved and particulate phosphorus concentrations) tended to be substantially higher on the Eastern Shore, lower in Western Maryland, and moderate in the central part of the state (Figures 3-41 and 3-42). Results for orthophosphate share a similar pattern and are shown (Figure 3-43). Appendix Tables B-31 and B-32 detail these results by PSU.

3.5.2 Other Water Quality Parameters

Dissolved oxygen concentrations at most locations were greater than 5 mg/l, the COMAR standard and a level generally considered healthy for aquatic life (Figure 3-44, Appendix Table B-33). The only PSU with a mean DO < 5 mg/l was Upper Pocomoke River, where swampy blackwater streams and sluggish waters are naturally lower in DO, but also particularly susceptible to BOD loading from anthropogenic sources. Individual sites with low DO should be examined for similar, natural causes before concluding that impacts exist. Estimates of the percentage of stream miles with low DO are given in Figure 3-45 (Appendix Table B-34). Seasonal monitoring of streams suspected to have low DO problems and examination of watershed factors would help to diagnose situations where the problem is persistent and can be linked to anthropogenic causes.

As expected (because sampling generally is done when water clarity is good), turbidity was generally low (Figure 3-46, Appendix Table B-35), with the Nanticoke River showing substantially higher turbidity levels than the other PSUs sampled. However, a more complete characterization of turbidity in a given stream would require monitoring during storm events.

Sulfate values were not generally high (Figure 3-47, Appendix Table B-36), although values in Potomac River

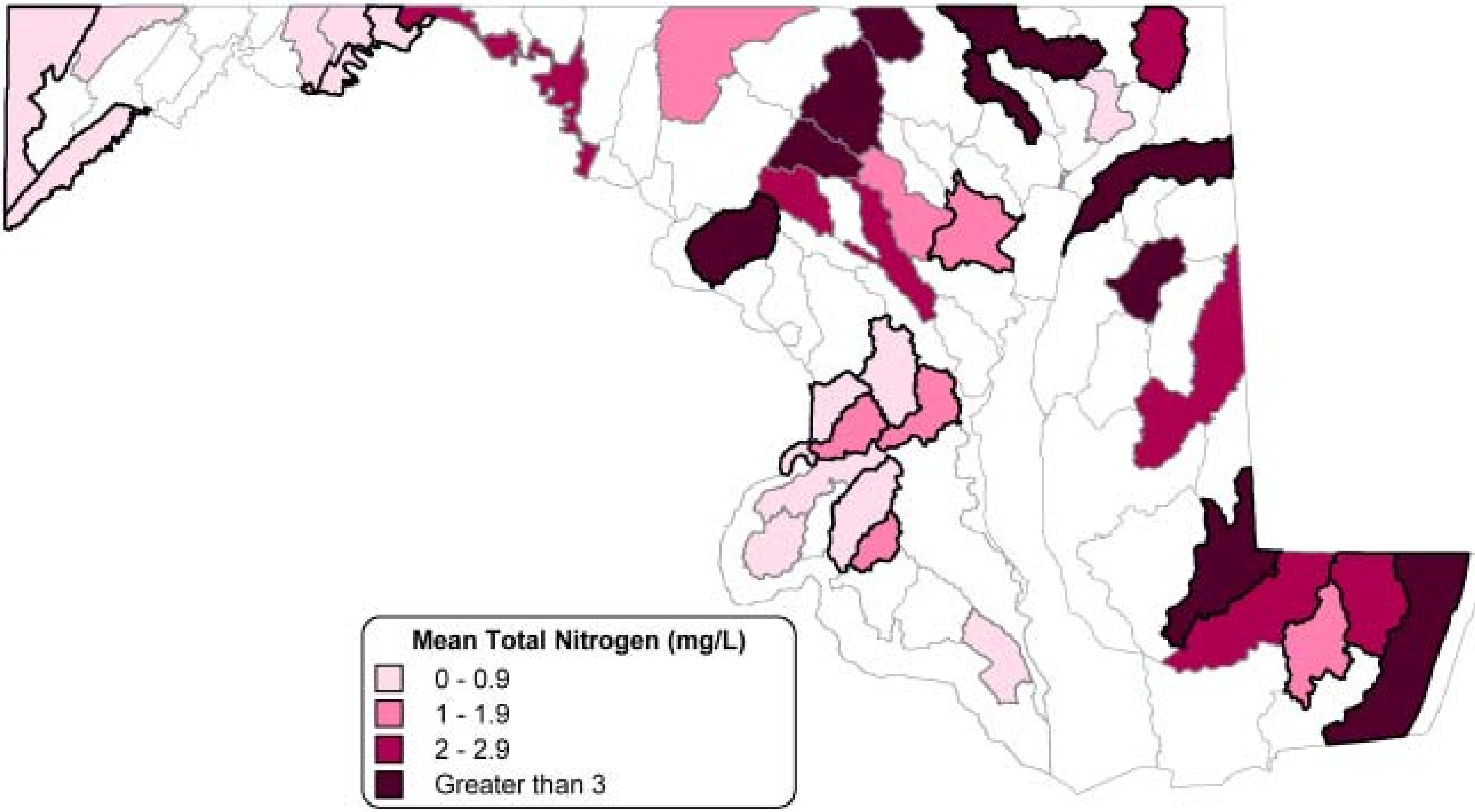


Figure 3-35. Distribution of total nitrogen values (mg/L) for the MBSS PSUs sampled in 2000 and 2001. PSUs sampled in 2001 have bolder outlines than those sampled in 2000.

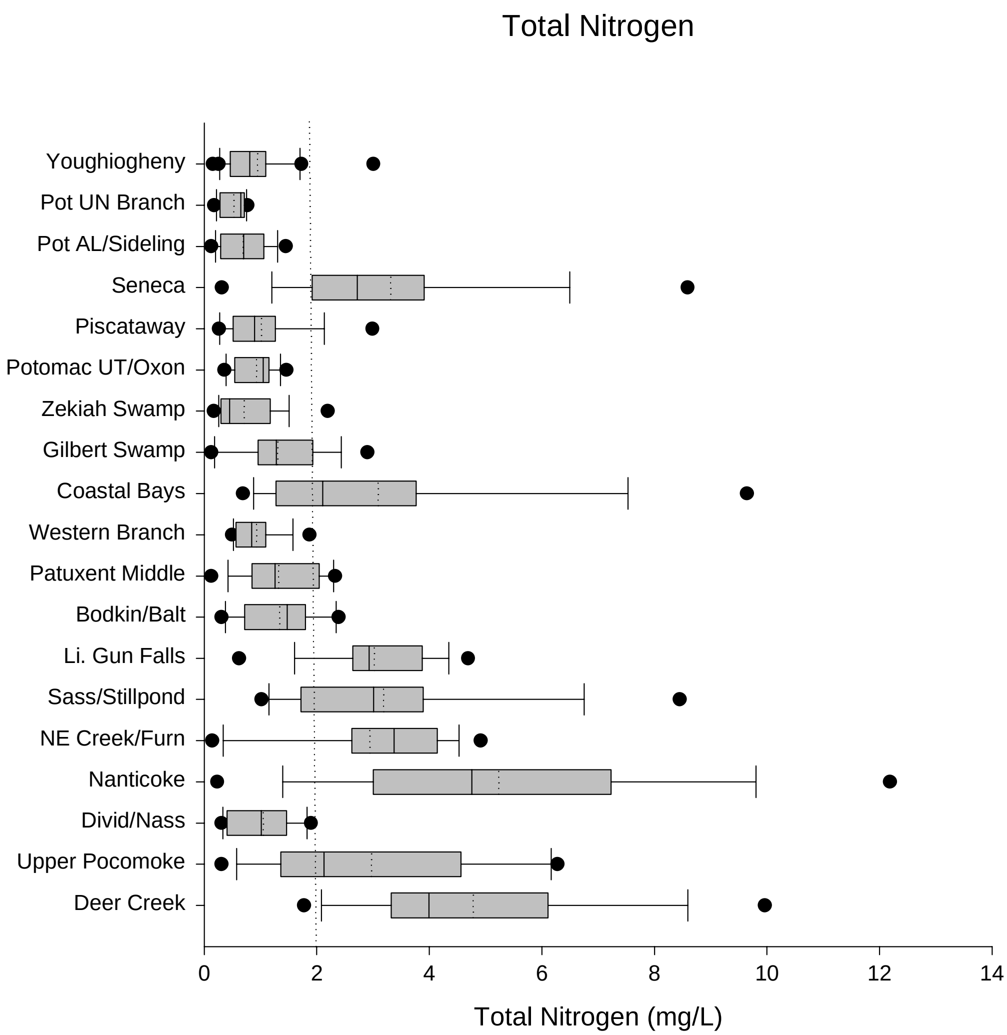


Figure 3-36. Distribution of total nitrogen values (mg/L) for the MBSS PSUs sampled in 2001. Dotted line represents threshold above which anthropogenic impacts are likely.

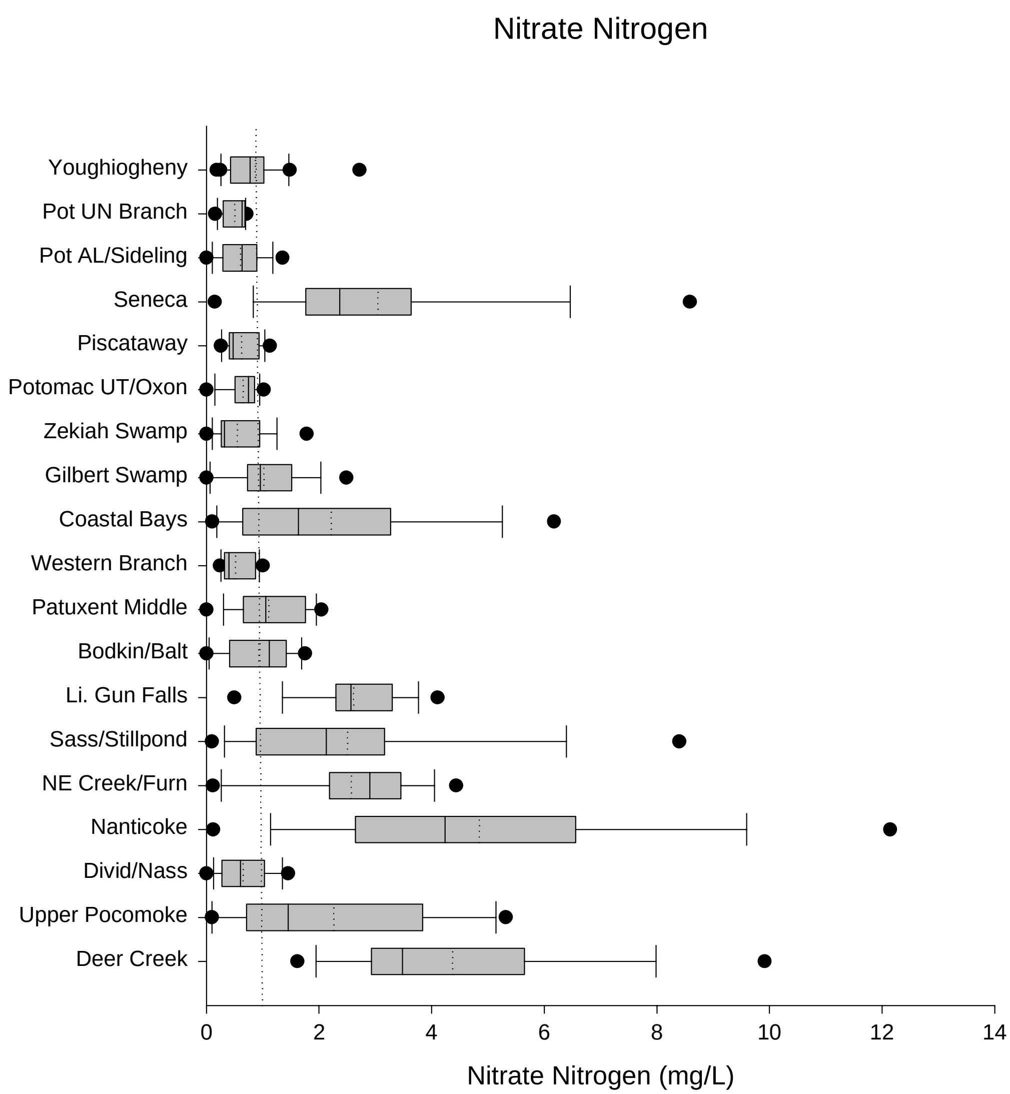


Figure 3-37. Distribution of nitrate-nitrogen values (mg/L) for the MBSS PSUs sampled in 2001. Dotted line represents threshold above which anthropogenic impacts are likely.

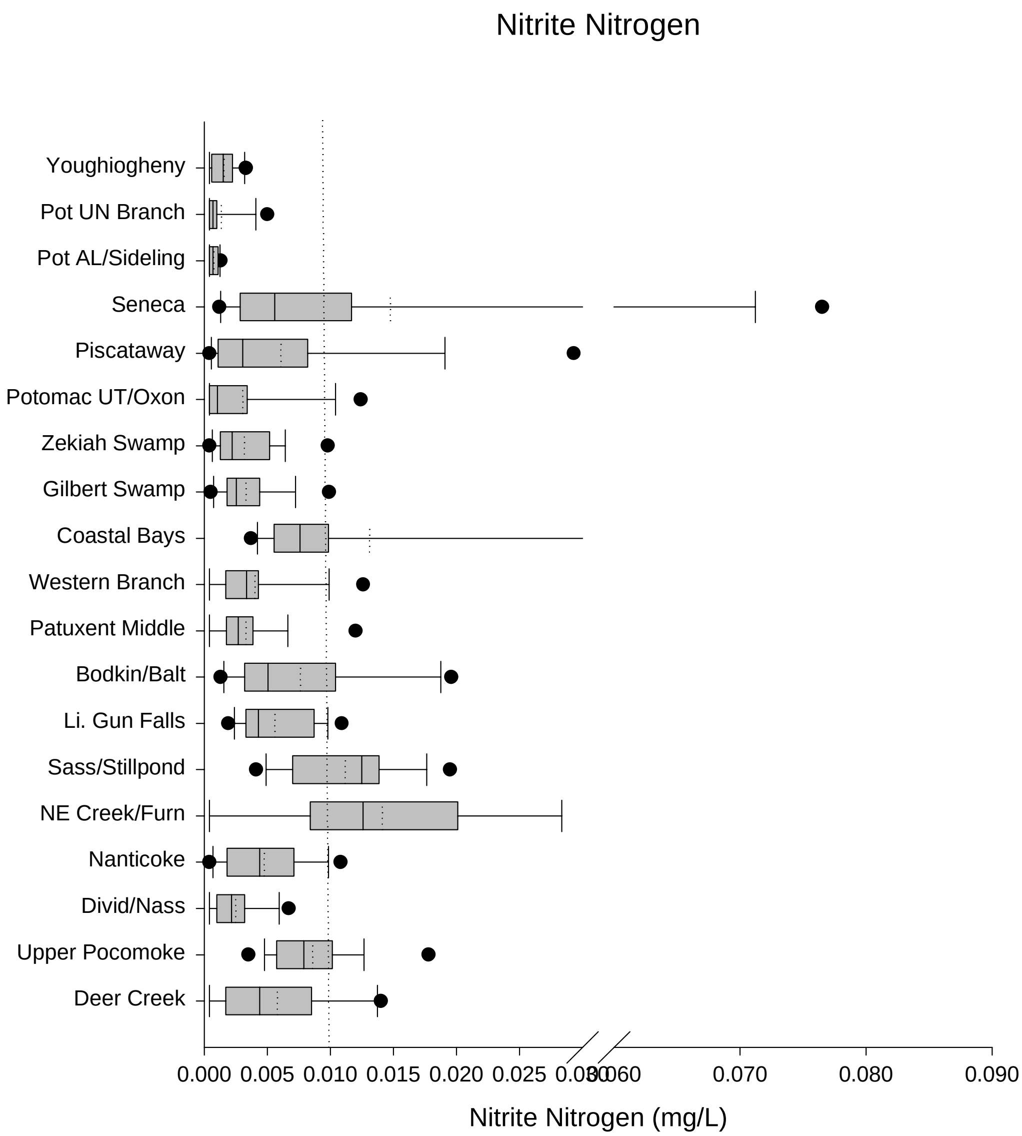


Figure 3-38. Distribution of nitrite-nitrogen values (mg/L) for the MBSS PSUs sampled in 2001. Dotted line represents threshold above which anthropogenic impacts are likely.

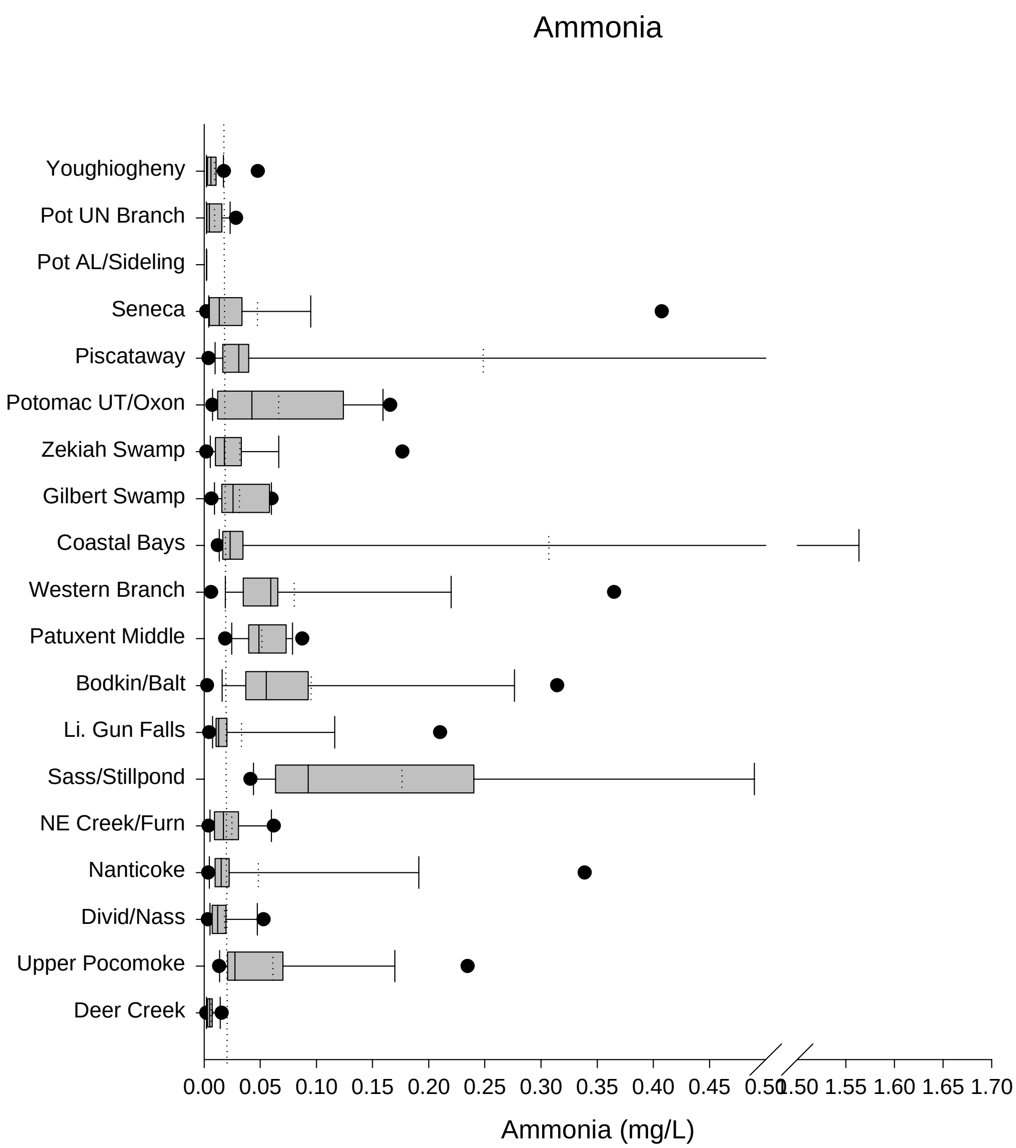


Figure 3-39. Distribution of ammonia values (mg/L) for the MBSS PSUs sampled in 2001. Dotted line represents threshold above which anthropogenic impacts are likely.

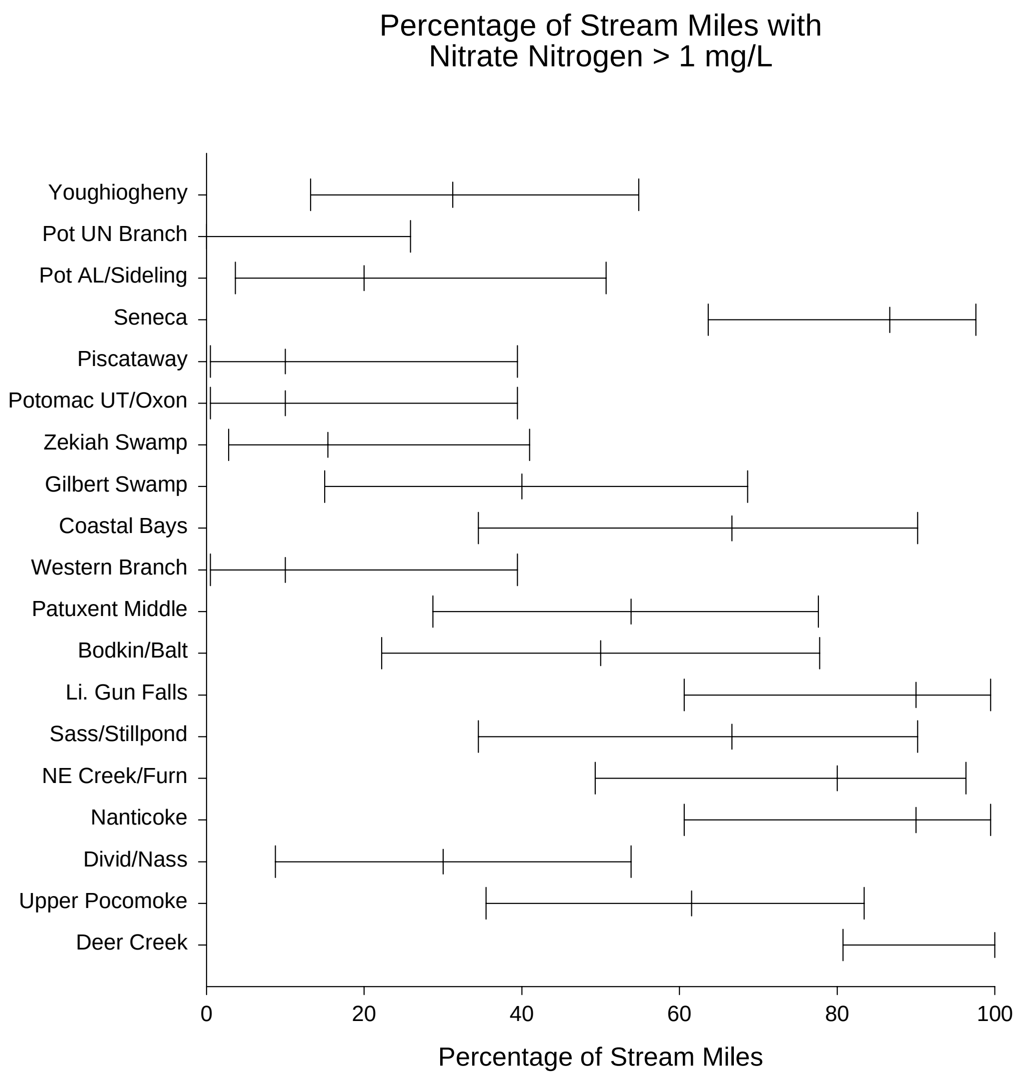


Figure 3-40. Percentage of stream miles with nitrate-nitrogen greater than 1.0 mg/L for the MBSS PSUs sampled in 2001

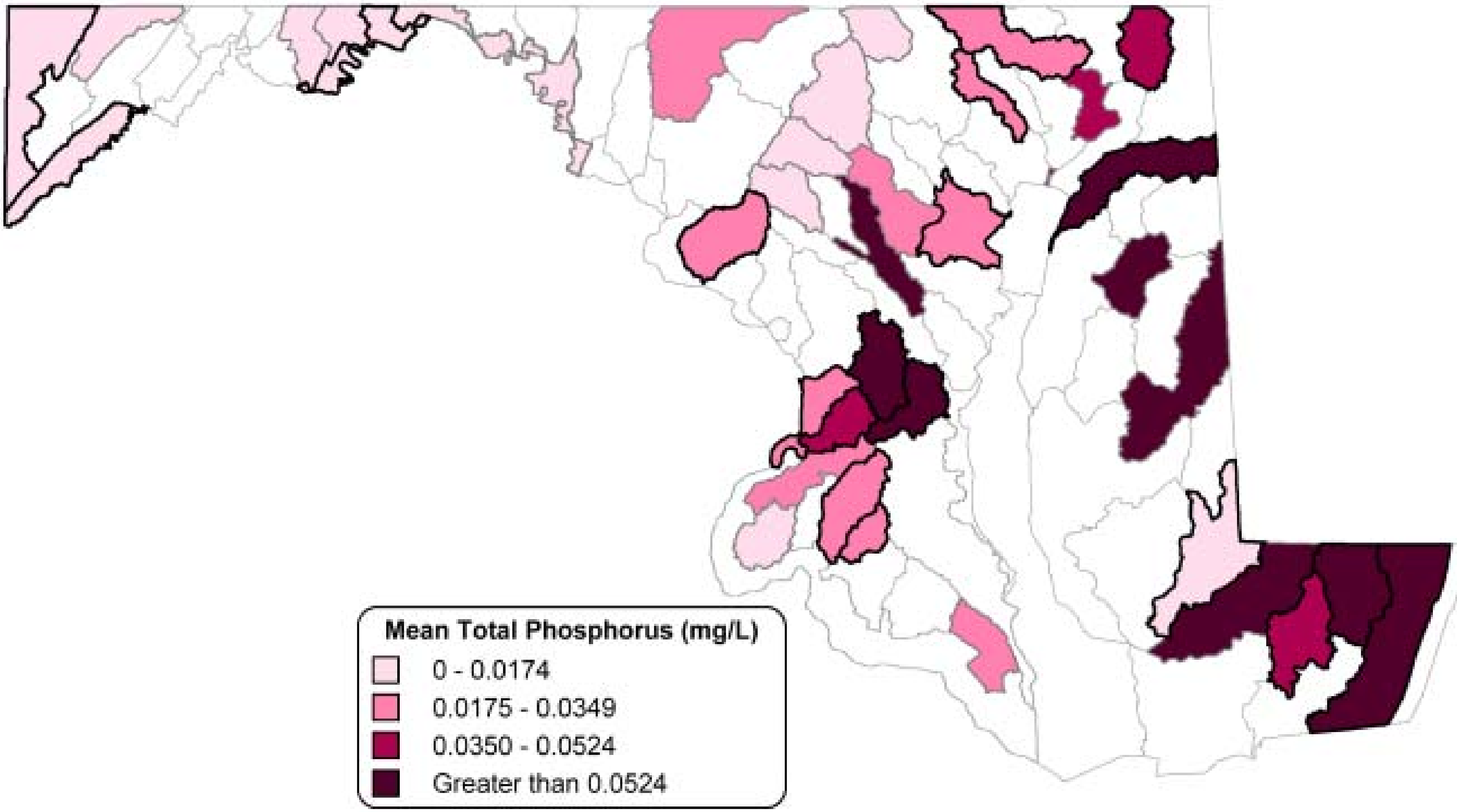


Figure 3-41. Distribution of total phosphorus values (mg/L) for the MBSS PSUs sampled in 2001. PSUs sampled in 2001 have bolder outlines than those sampled in 2000.

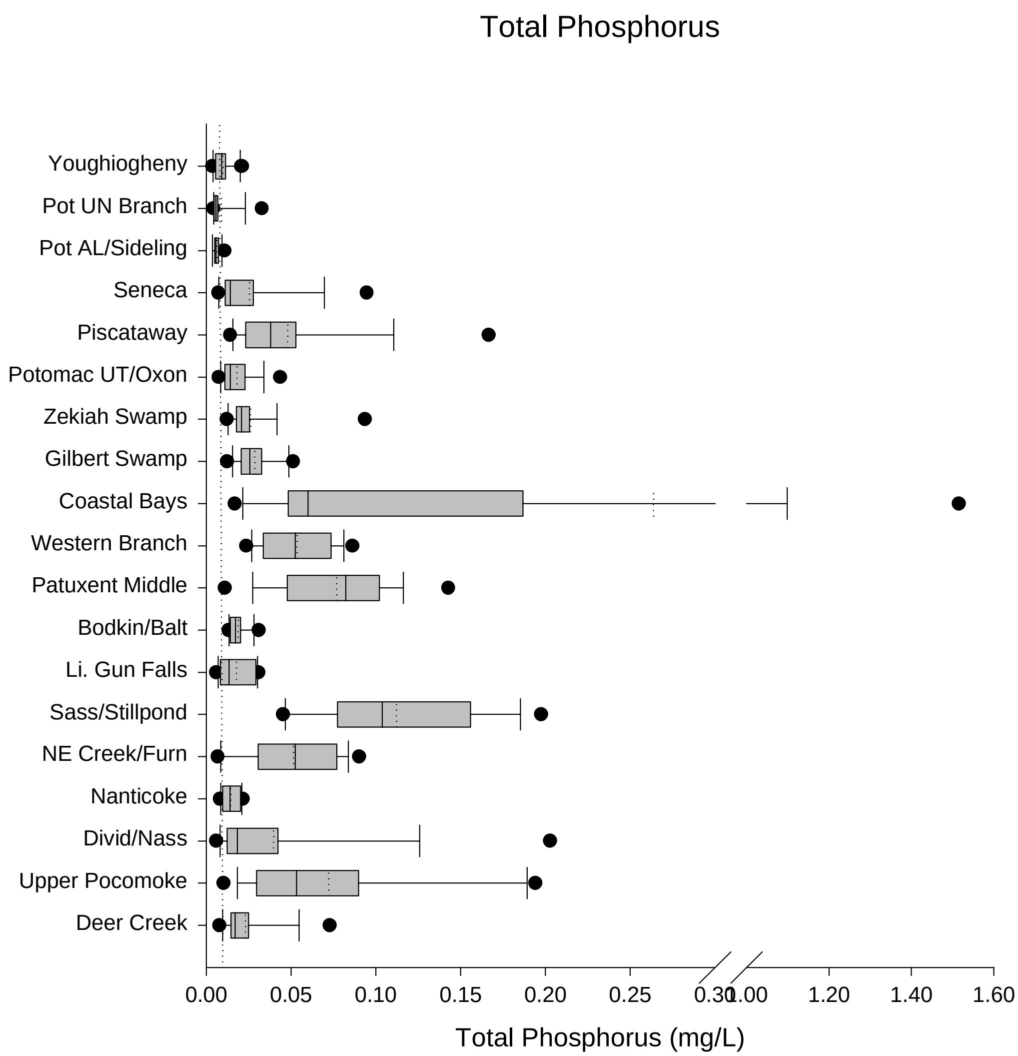


Figure 3-42. Distribution of total phosphorus values (mg/L) for the MBSS PSUs sampled in 2000 and 2001. Dotted line represents threshold above which anthropogenic impacts are likely.

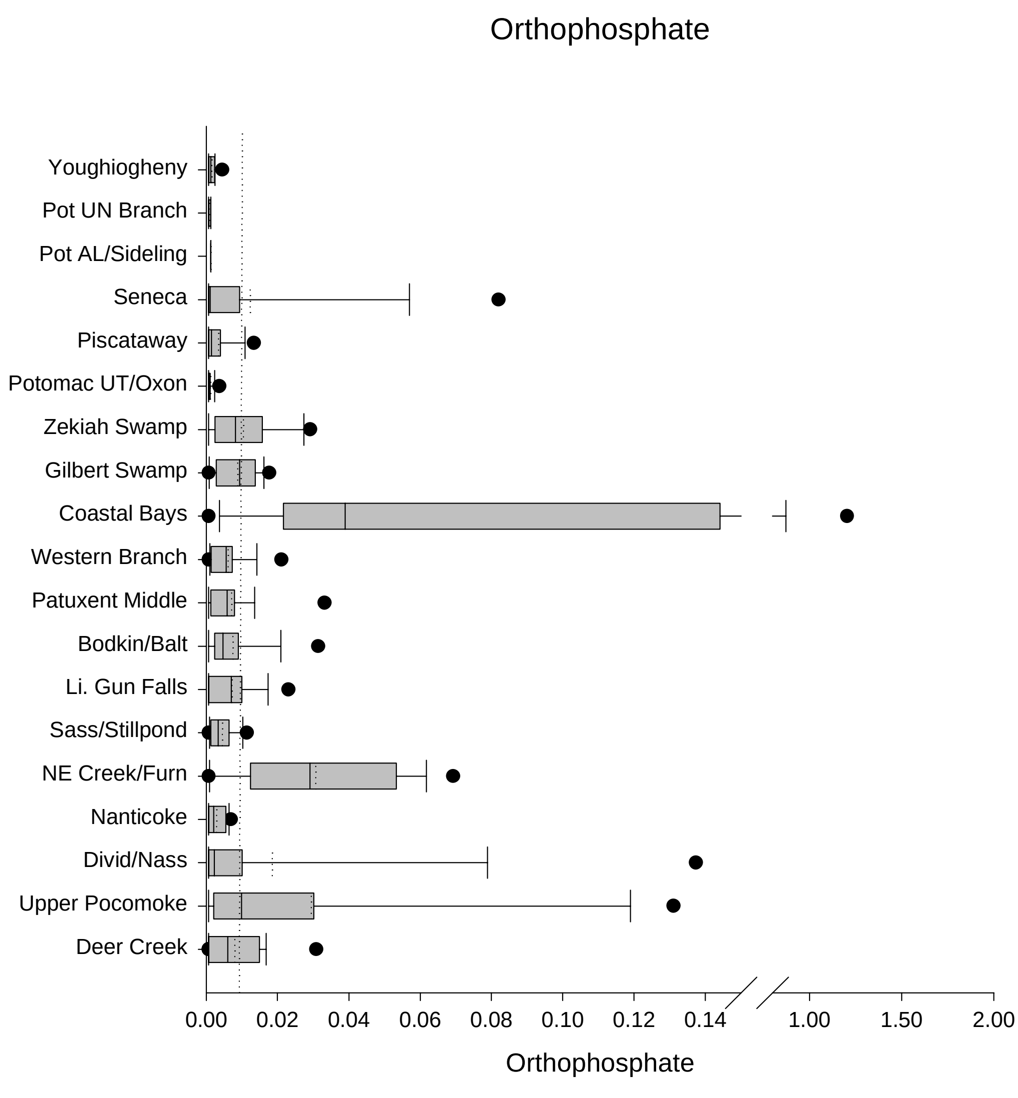


Figure 3-43. Distribution of orthophosphate values (mg/L) for the MBSS PSUs sampled in 2001. Dotted line represents threshold above which anthropogenic impacts are likely.

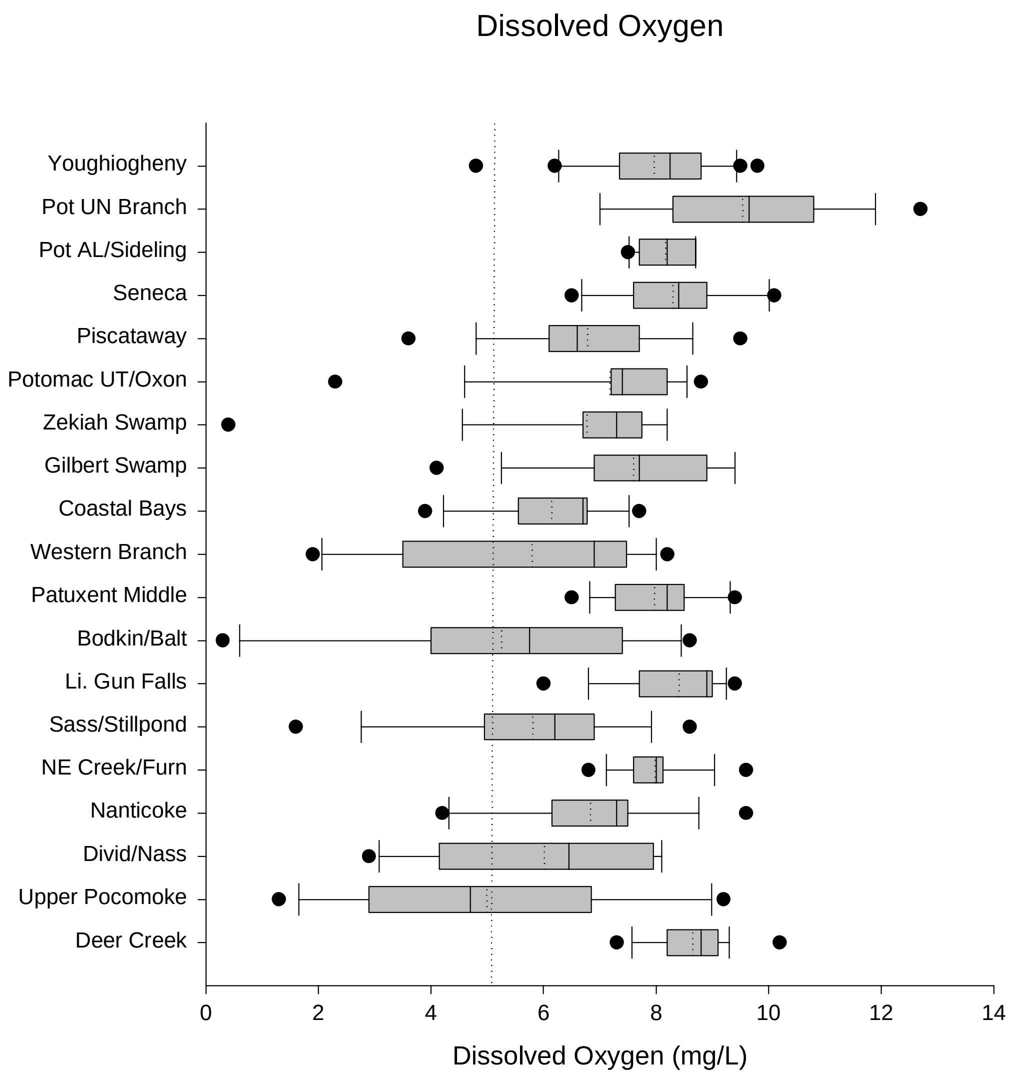


Figure 3-44. Distribution of dissolved oxygen concentrations (mg/L) for the MBSS PSUs sampled in 2000 and 2001. Dotted line represents threshold below which anthropogenic impacts are likely.

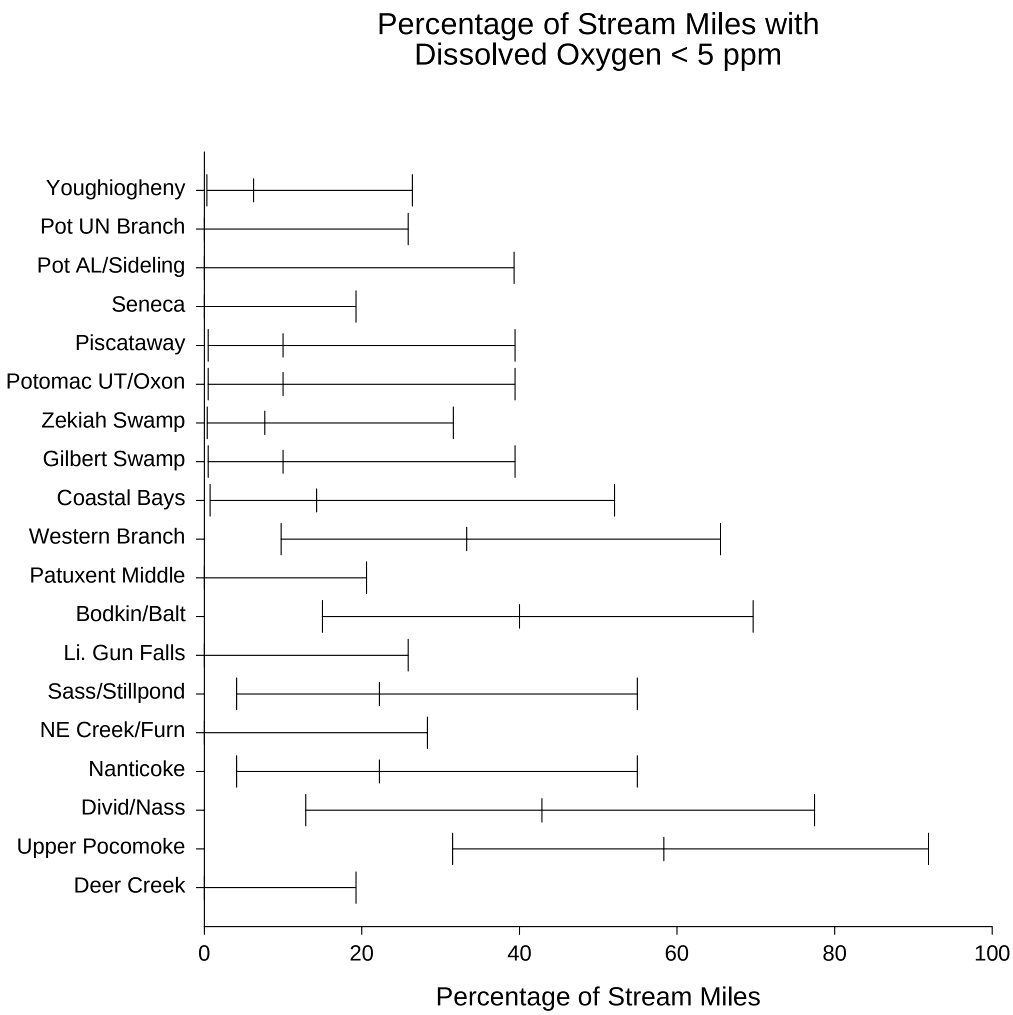


Figure 3-45. Percentage of stream miles with dissolved oxygen concentrations < 5.0 mg/L for the MBSS PSUs sampled in 2001

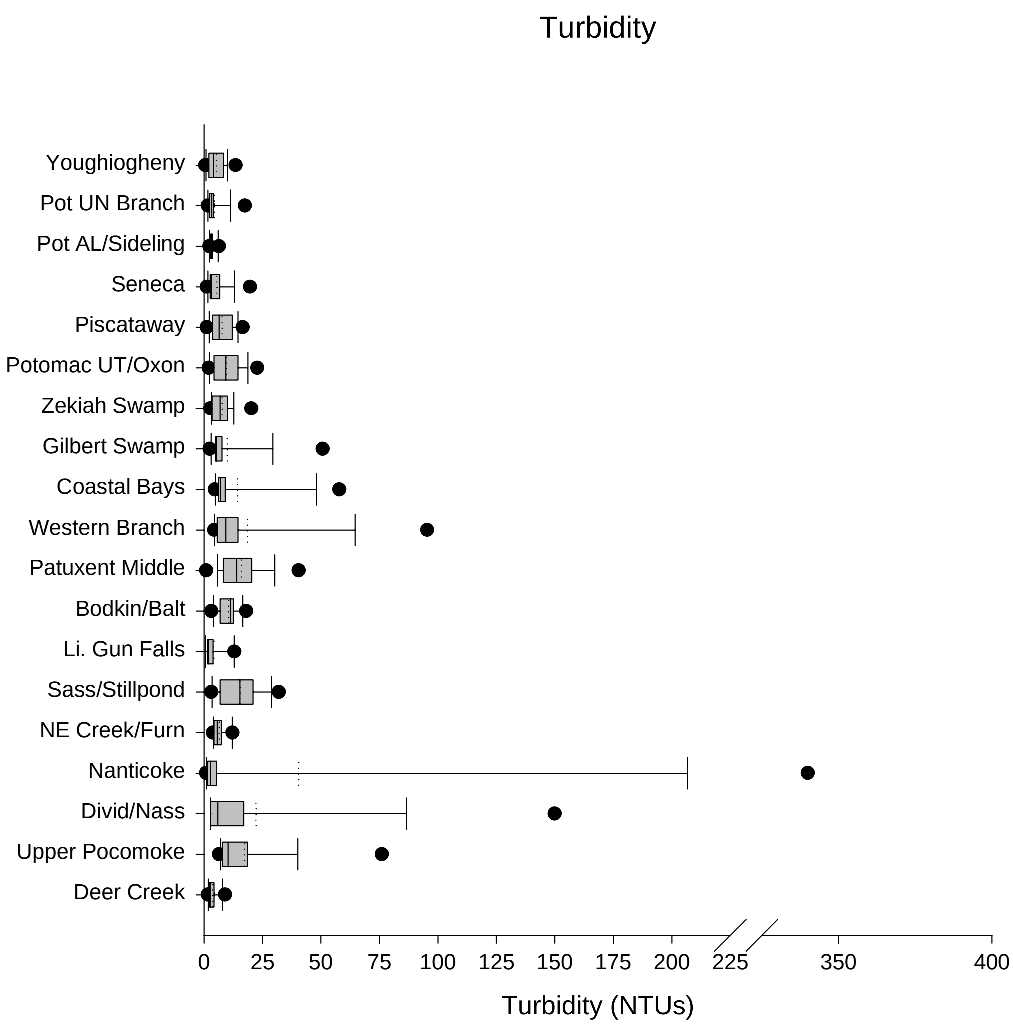


Figure 3-46. Distribution of turbidity values (NTUs) for the MBSS PSUs sampled in 2000 and 2001. Dotted line represents threshold above which anthropogenic impacts are likely.

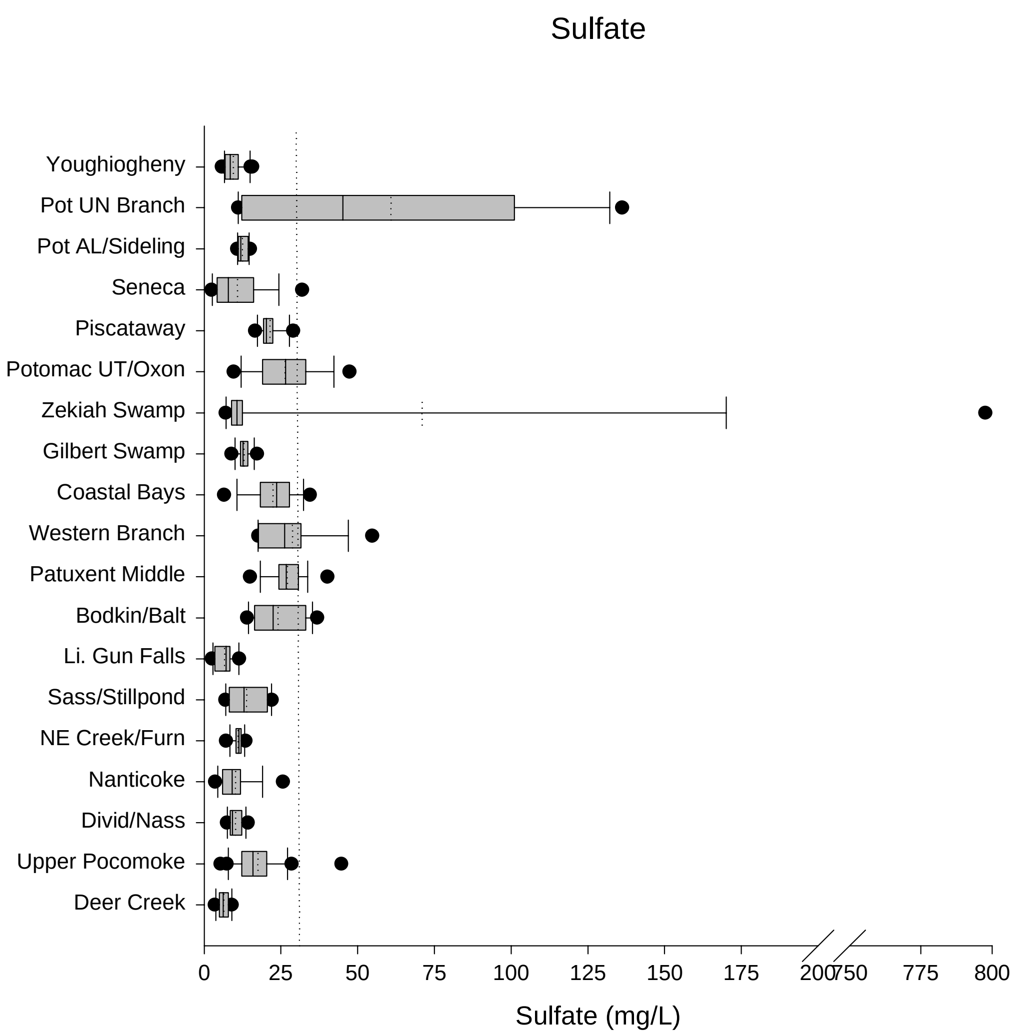


Figure 3-47. Distribution of sulfate values (mg/L) for the MBSS PSUs sampled in 2000 and 2001. Dotted line represents threshold above which anthropogenic impacts are likely.

Upper North Branch, where acid mine drainage to streams is a recognized problem, showed substantially higher values than the other PSUs sampled.

Chloride (Figure 3-48, Appendix Table B-37) tended to be highest in urban areas, especially Bodkin Creek/Baltimore Harbor. Several sites in this PSU were located close to major highways (such as Interstate 95) where high chloride levels indicate a major impact of road salt application.

As expected, mean dissolved organic carbon (DOC) (Figure 3-49, Appendix Table B-38) was highest in Coastal Plain basins, especially on the Eastern Shore.

3.6 Land Use

A measure of anthropogenic influence at the landscape scale is watershed land use. Watersheds form natural geographic units for assessing impacts on streams, because land use within the watershed (or catchment) upstream of a specific stream site is representative of many of the human activities affecting the stream at that point. As such, land cover serves as a surrogate for a variety of stressors.

In much of the United States, conversions of naturally vegetated watershed lands to urban and agricultural uses have resulted in serious impacts to streams and their aquatic inhabitants. Some investigations have indicated that development of even small portions of the watershed area can have detrimental effects on streams (Schueler 1994). Impervious surfaces, such as roads, parking lots, sidewalks, and rooftops, cause a rapid increase in the rate at which water is transported from the watershed to its stream channels. Effects include more variable stream flows, increased erosion from runoff, habitat degradation caused by channel instability, increased nonpoint source pollutant loading, elevated temperatures, and losses of biological diversity.

Reviews of stream research in numerous watersheds (Center for Watershed Protection 1998, Schueler 1994) indicate that impacts on stream quality are commonly noted at about 10% coverage by impervious surface. Effects on sensitive species may occur at even lower levels. With even more impervious surface, most notably, at about 25-30% of catchment area, studies have shown that numerous aspects of stream quality become degraded, including biological integrity, water quality, and physical habitat quality (Center for Watershed Protection 1998).

Of the 19 PSUs sampled in 2001, the greatest amounts of urban land occurred in PSUs located in the central portion of the State (Figure 3-50, Appendix Table B-39). Bodkin Creek/Baltimore Harbor had the greatest mean percentage of urban land use in the upstream catchments (59%), followed by Potomac River Upper Tidal/Oxon Creek (41%), and Piscataway Creek (34%). PSUs in western Maryland and on the Eastern Shore had much smaller percentages of urban land in catchments upstream of MBSS sites.

The percentage of impervious surface (calculated as 75% of the value for high density urban land use plus 25% of the value for low density urban land use) followed the patterns shown in the percentage of urban land use (Appendix Table B-40). The highest mean value of percentage of impervious surface occurred in Bodkin Creek/Baltimore Harbor (24%, followed by Potomac River Upper Tidal/Oxon Creek (14%) and Piscataway Creek (11%). The remaining PSUs all had much lower percentages of impervious surface - with mean values of less than 10%.

The greatest amounts of agricultural land uses in upstream catchments occurred in PSUs sampled on the Eastern Shore, and in several watersheds in central Maryland (Figure 3-51, Appendix Table B-41). Sassafras River/Stillpond-Fairlee had the highest mean agricultural land use (81%), followed by Seneca Creek (68%), and Deer Creek (68%, including one site with 100% agricultural land use in the upstream catchment).

Western Maryland contains the PSUs with the largest amounts of forested land use in the state (Figure 3-52, Appendix Table B-42). Potomac River Allegany County/ Sideling Hill Creek had the largest mean percentage of forested land use in upstream catchments (92%, including two sites with 100% forested land use in the upstream catchment). Potomac River Upper North Branch and the Youghiogheny River followed (88 and 74%, respectively). The mean amount of forested land in upstream catchments in PSUs in central Maryland and on the Eastern Shore was significantly lower, although several PSUs had sites with 100% or nearly 100% forested land in their upstream catchments (Coastal Bays PSU (100%) and Upper Pocomoke River (99%)).

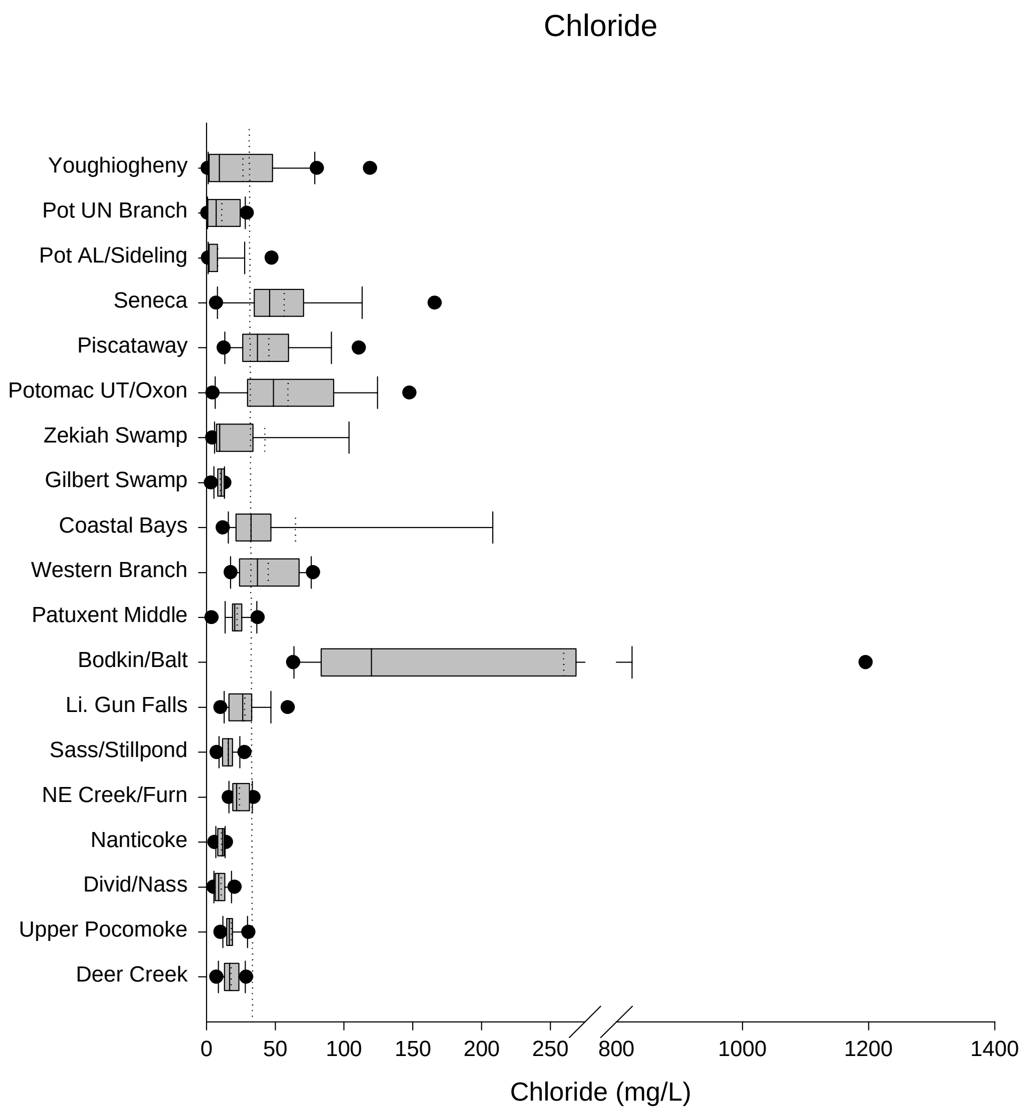


Figure 3-48. Distribution of chloride values (mg/L) for the MBSS PSUs sampled in 2000 and 2001. Dotted line represents threshold above which anthropogenic impacts are likely.

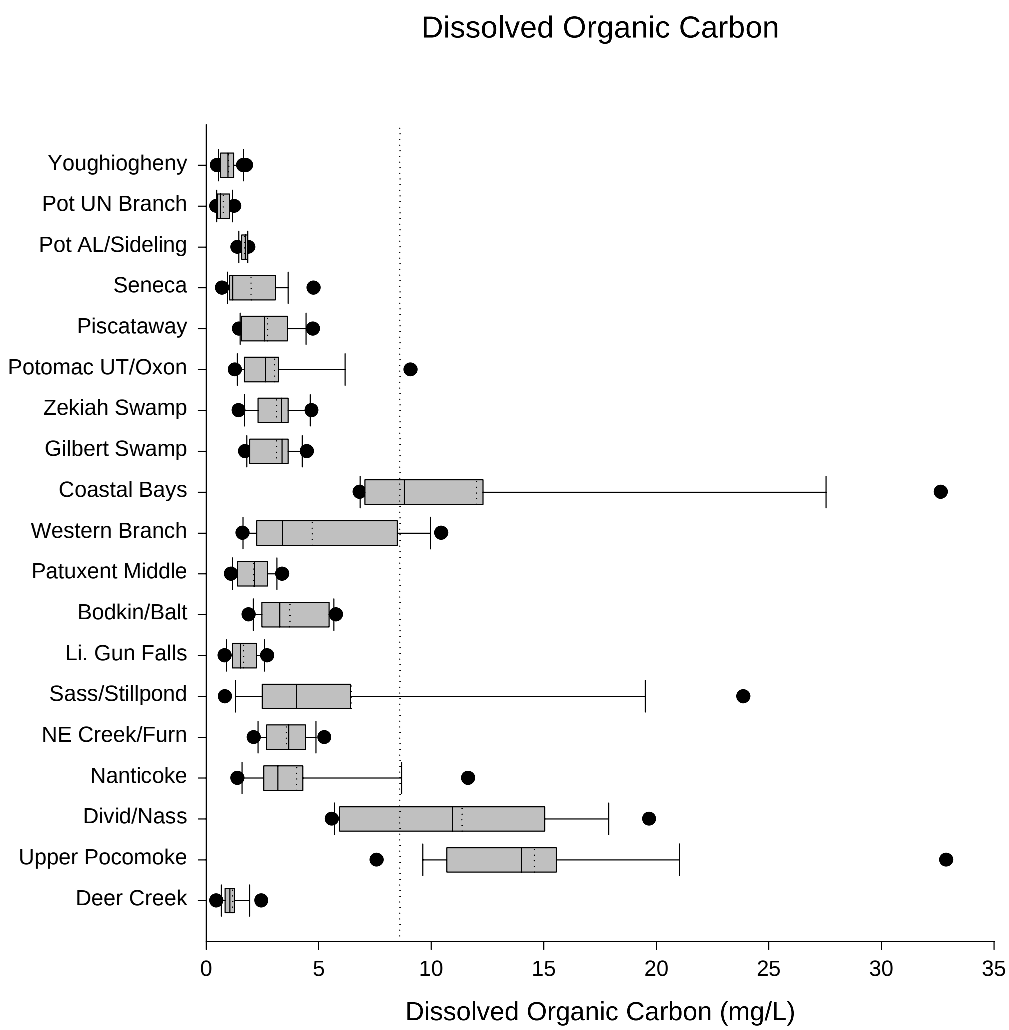


Figure 3-49. Distribution of dissolved organic carbon values (mg/L) for the MBSS PSUs sampled in 2000 and 2001. Dotted line represents threshold above which blackwater stream conditions or (less commonly) anthropogenic impacts are likely.

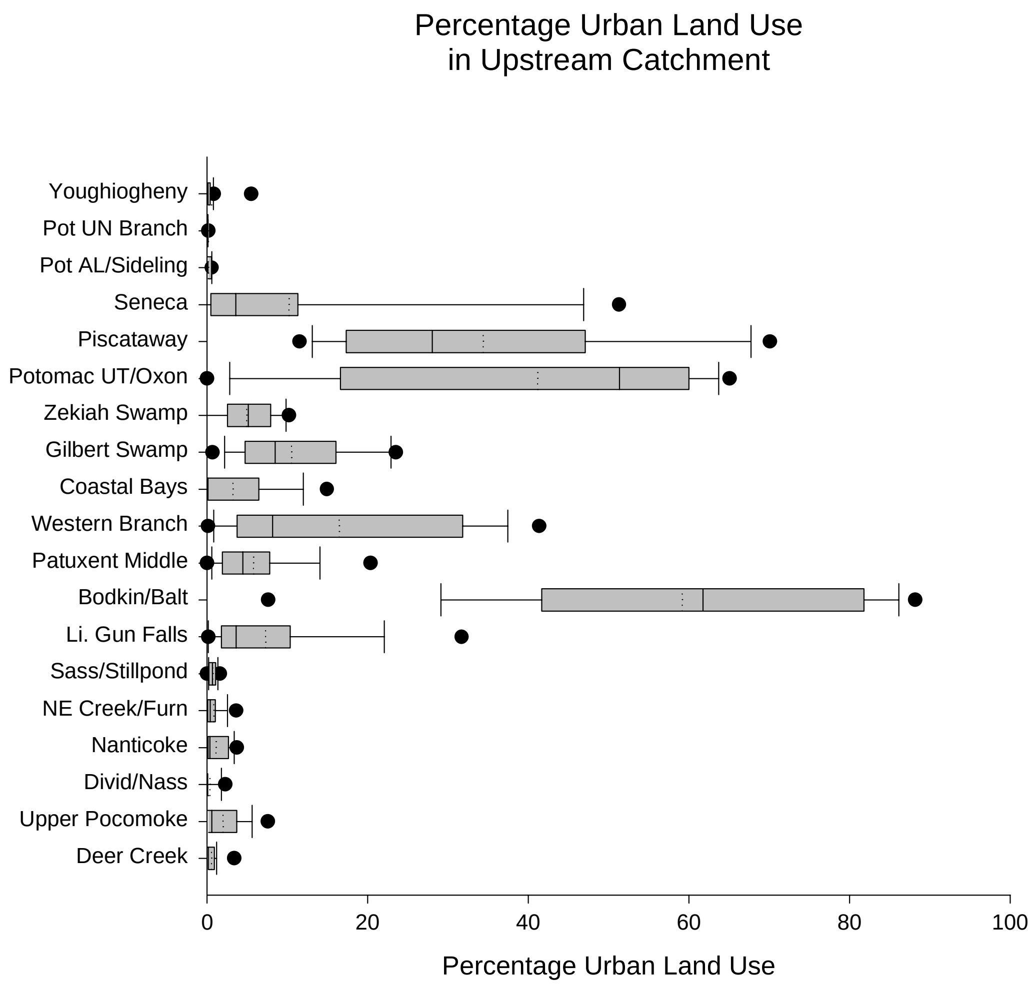


Figure 3-50. Distribution of the percentage of urban land in the catchments upstream of the MBSS 2001 sites.

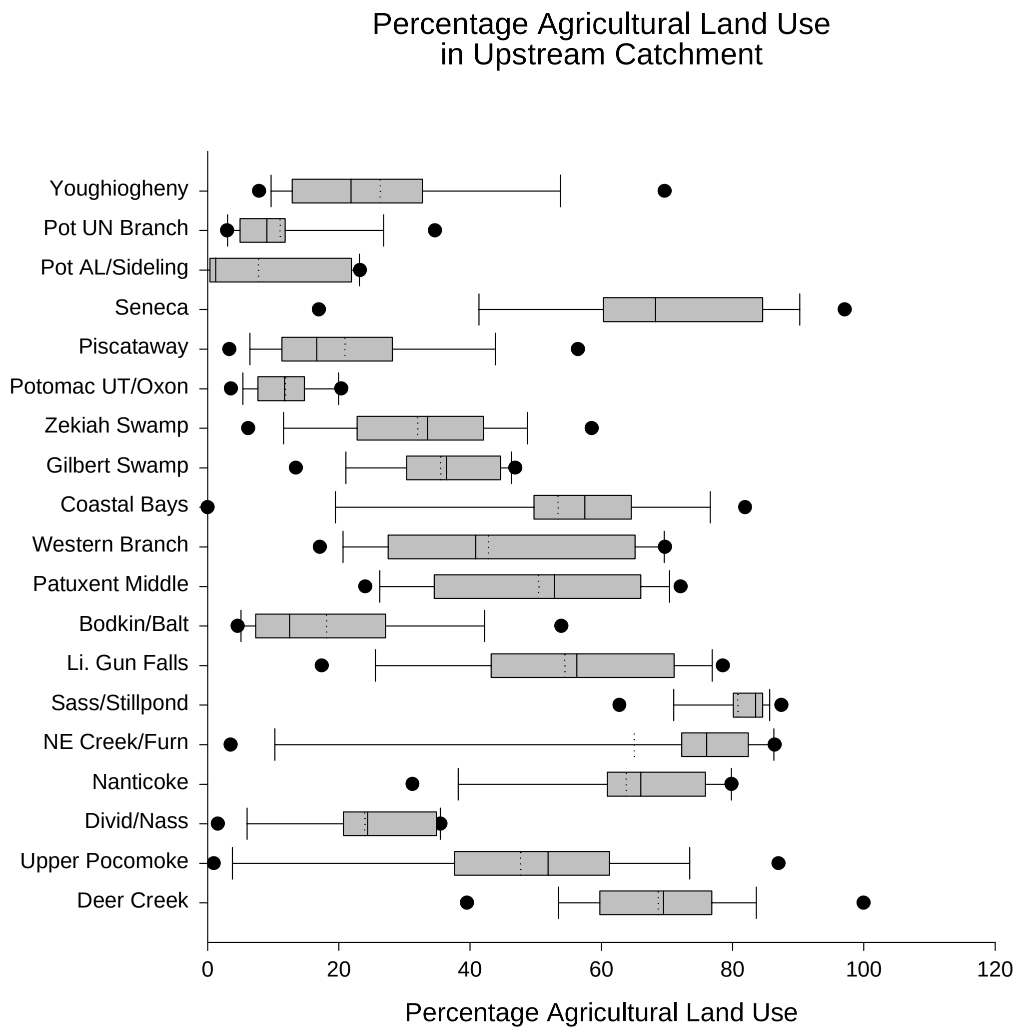


Figure 3-51. Distribution of the percentage of agricultural land in the catchments upstream of the MBSS 2001 sites.

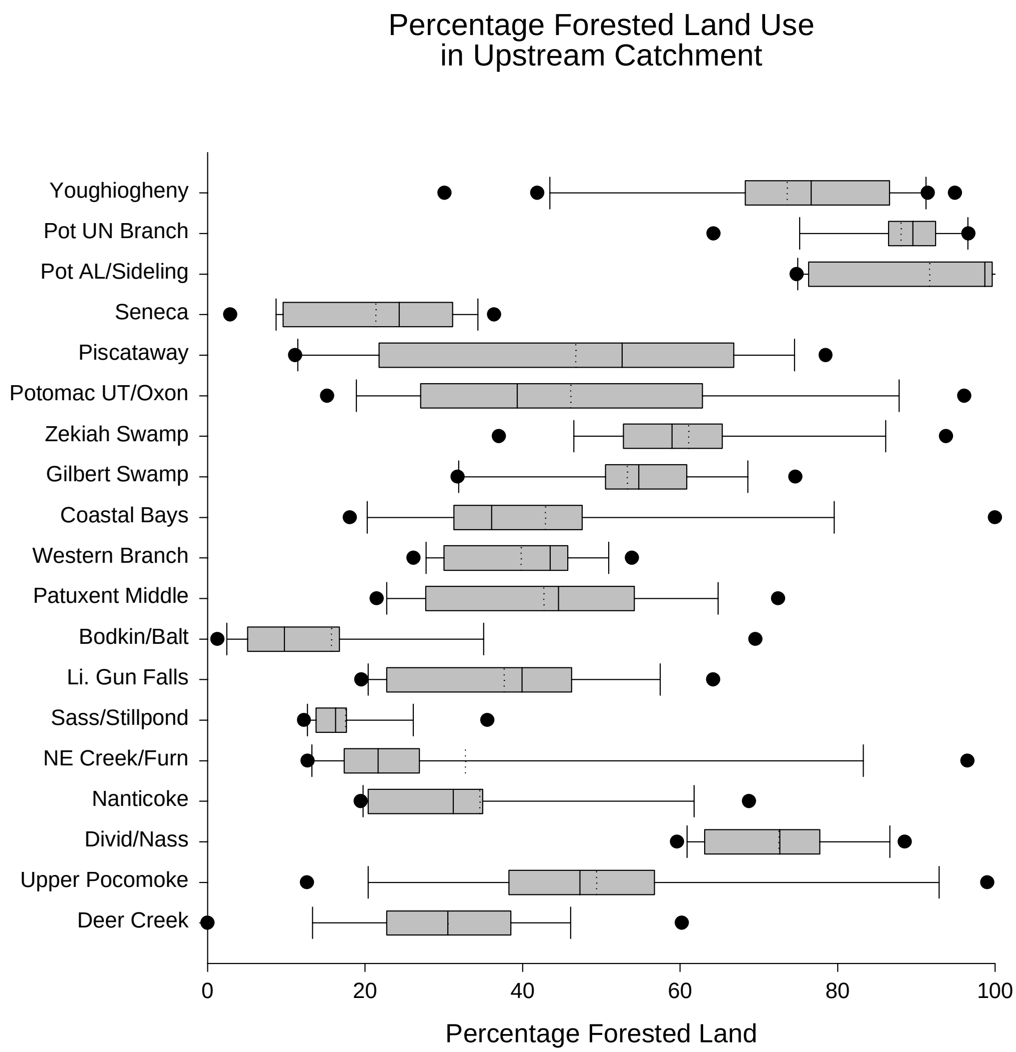


Figure 3-52. Distribution of the percentage of forested land in the catchments upstream of the MBSS 2001 sites.

4 SUMMARY OF SAMPLING RESULTS FOR INDIVIDUAL WATERSHEDS

Since the primary focus of the 2000-2004 Round Two of the MBSS (or Survey) is on smaller watersheds than in Round One, more attention has been paid to examining sampling results and potential stressors at individual sites. Although a complete assessment of watershed-wide conditions would require more information, data collected at specific MBSS sites provide a starting point for understanding and describing the condition of the watershed.

This chapter includes a summary for each of the 18 primary sampling units or PSUs (single or combined 8-digit watersheds) randomly sampled in the 2001 MBSS. Each summary begins with a map of the PSU, which shows 8-digit watershed and 12-digit subwatershed boundaries, county boundaries, major towns and roads, and selected public lands. This information provides a geographical context for the sites sampled by the Survey. These maps also include the locations of the MBSS sample points and MBSS Stream Waders sample locations (see sidebar in this chapter for further information regarding the MBSS Stream Waders program), with symbols indicating the fish and benthic IBI scores (a key to this map is included in Table 4-1). The same page of each PSU summary lists the total land area and the total number of sampleable stream miles (by individual 8-digit watershed).

Each PSU summary includes a land cover map derived from the Multi-Resolution Land Characteristics (MRLC) Version 98-07 (based on remote sensing data from the early 1990s). A key to this map is provided in Table 4-1. A bar chart for each 8-digit watershed shows the percentage of land in each land cover class.

Following the maps are tables containing a variety of information on the sites sampled in each PSU. The first table contains locational information for each site, including the stream name, 12-digit subwatershed code,8-digit watershed name, basin, county, stream order, and upstream catchment area. The second table is one containing information pertinent to the indicators calculated for each site (fish, benthic, and physical habitat). The third table gives the percentage of the upstream catchment area in urban, agricultural, forested, or other (water, barren, and/or wetlands) land cover for each site. Below these tables is a short summary of the conditions in the PSU, including pertinent comments taken from field data sheets. A water chemistry table is provided, including values for the analytes measured at each site (see Chapter 2). Two tables providing information on physical habitat quality and modifications are also included in each PSU report. Throughout these tables, values that exceed or fall short of established thresholds (denoting likely degraded condition or potential stress) are shaded in yellow. The final table is a list of Stream Waders sites in the PSU, along with the family level IBI score calculated for each site. A key to the variables in all of these tables is given in Table 4-1.

Finally, each PSU report includes a list of organisms found throughout the PSU. Included on this page are species lists for fish, exotic plants, and herpetofauna, as well as a taxa list for benthic macroinvertebrates. Taken together, these data can be used to begin to assess stream quality in each PSU. For example, in the Potomac River Upper Tidal/Oxon Creek PSU, indicator scores at most sites are generally low, indicating that most streams sampled in the PSU are disturbed. Maps and data also indicate that urban and suburban land uses are widespread and that many sampled sites had elevated chloride, nitrogen (especially ammonia), and phosphorus levels, as well as channelization and erosion problems. In this PSU, development is probably a significant stressor on stream water quality, contributing to elevated pollution and physical habitat degradation, which in turn result in low indicator scores. A similar assessment can be done for each PSU, providing a preliminary identification of the specific stressors of concern in the PSU.

Table 4-1. Key to PSU reports for PSUs sampled in the 2001 MBSS

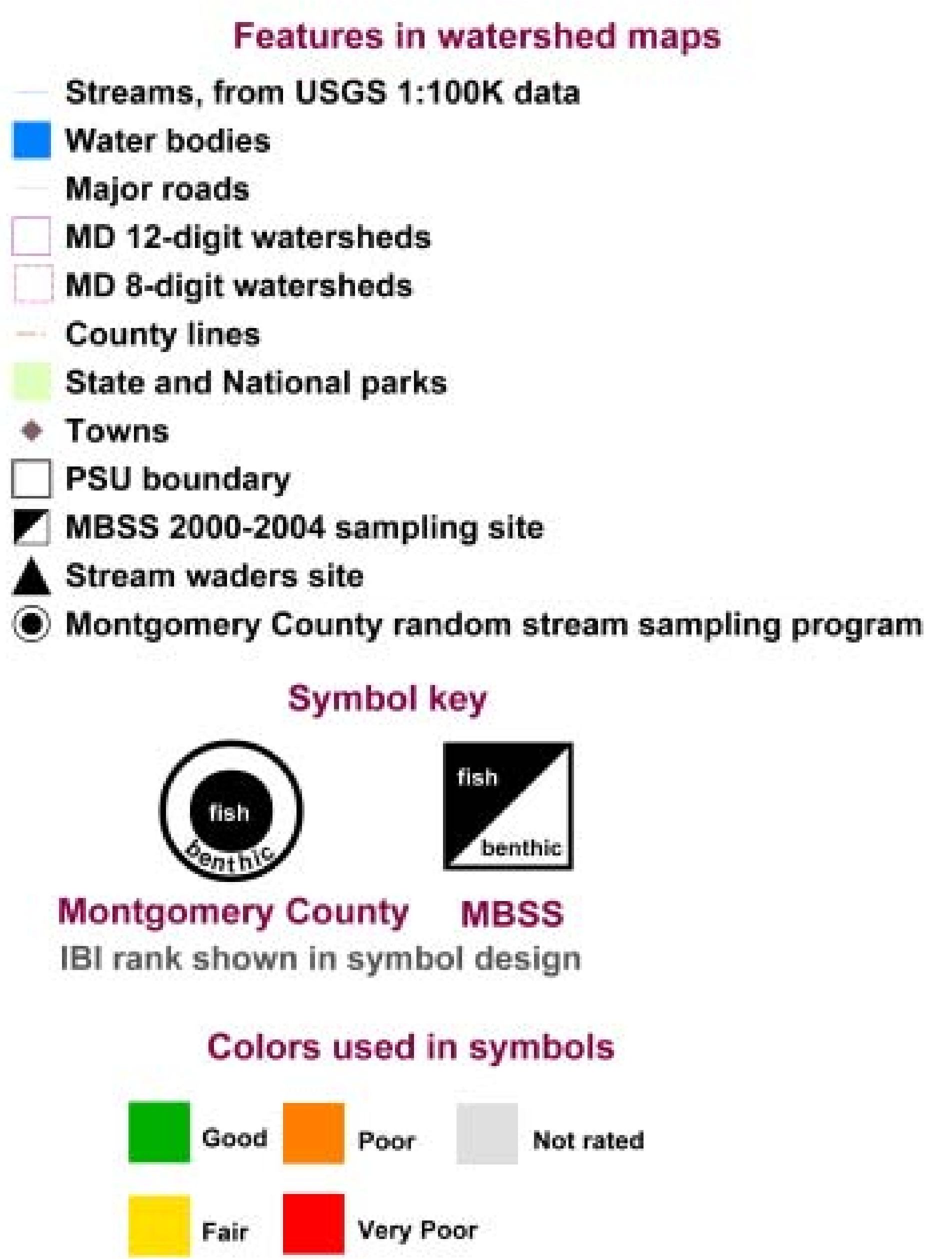


Table 4-1. (Continued)

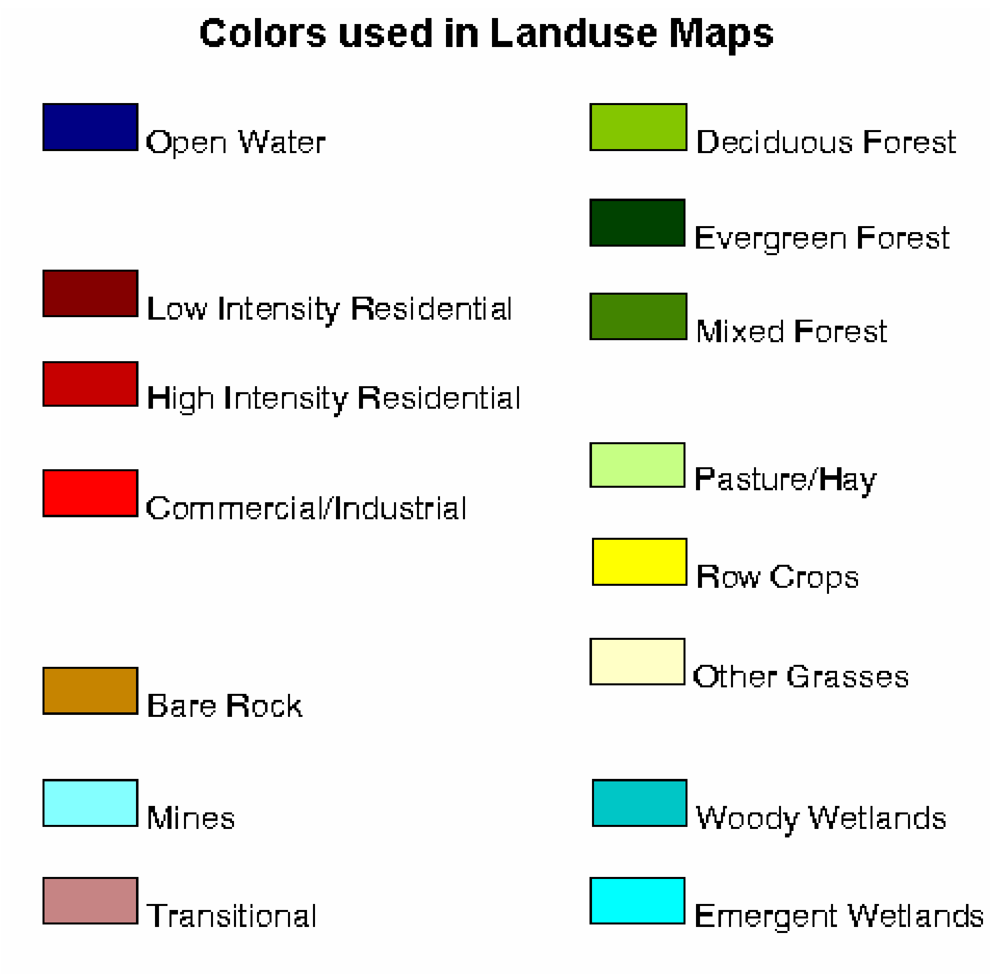


Table 4-1. (Continued)

Guide to Variables in PSU Reports

Site Information

Site: MBSS site name, in the following format: Watershed Abbreviation - Segment Number - Site Type - Year Sampled (Site Type R = Randomly selected site)

Stream Name: Name of stream sampled

12-digit Subwatershed Code: Maryland 12-digit watershed code

8-digit Watershed: Maryland 8-digit watershed name

Basin: Maryland drainage basin name

County: Maryland county

Date Sampled Spring: Date site was sampled in the spring

Date Sampled Summer: Date site was sampled in the summer (NS = Not Sampled)

Order: Strahler stream order

Catchment Area: Area of upstream catchment in acres

Indicator Information

FIBI: Fish Index of Biotic Integrity, scored on the following scale:

1.0 - 1.9 Very Poor
2.0 - 2.9 Poor
3.0 - 3.9 Fair
4.0 - 5.0 Good
NS Not Sampled
NR Not Rated (site is not rated if catchment area is < 300 acres, or if the site is a brook trout or blackwater stream and would have received a score of less than 3.0)
Site is shaded if IBI score is < 3.0

BIBI: Benthic Index of Biotic Integrity, scored on the following scale:

1.0 - 1.9 Very Poor
2.0 - 2.9 Poor
3.0 - 3.9 Fair
4.0 - 5.0 Good
NS Not Sampled
NR Not Rated
Site is shaded if IBI score is < 3.0

Table 4-1. (Continued)

PHI: Physical Habitat Index, scored on the following scale:
0 - 11.9 Very Poor
12 - 41.9 Poor
42 - 71.9 Fair
72 - 100 Good
NS Not Sampled
NR Not Rated
Site is shaded if PHI score is < 42

Brook Trout Present: 0 = Not present in sample segment, 1 = Present in sample segment, NS = Not Sampled

Black Water Stream: 0 = Not a blackwater stream, 1 = Blackwater stream (pH < 5 or ANC < 200 μeq/L and Dissolved Organic Carbon ≥ 8 mg/L),
NS = Not Sampled

Catchment Land Use Information

Percent Urban: Percentage of urban land use in catchment upstream of site. Site is shaded if value is ≥ 25%.

Percent Agriculture: Percentage of agricultural land use in catchment upstream of site. Site is shaded if values is ≥ 75%.

Percent Forest: Percentage of forested land use in catchment upstream of site

Percent Other: Percentage of other land use in catchment upstream of site (other = wetlands, barren, and water)

Percent Impervious Surface: Percentage of impervious surface in catchment upstream of site. Site is shaded if value is ≥ 10%

Water Chemistry Information

Closed pH: Lab pH, sampled in the spring. Site is shaded if value is < 5.0.

Specific Cond.: Specific Conductivity (μmho/cm)

ANC: Acid Neutralizing Capacity (μeq/L). Site is shaded if value is < 200 ueq/L.

Cl: Chloride (mg/L). Site is shaded if value is ≥ 30 mg/L.

Nitrate-N: Nitrate Nitrogen (mg/L). Site is shaded if value is ≥ 1.0 mg/L

SO4: Sulfate (mg/L). Site is shaded if value is ≥ 50 mg/L.

T-P: Total Phosphorus (mg/L). Site is shaded if value is ≥ 0.0175 mg/L.

Ortho-P: Orthophosphate (mg/L). Site is shaded if value is ≥ 0.005 mg/L.

Nitrite: Nitrite Nitrogen (mg/L). Site is shaded if value is ≥ 0.0075 mg/L.

Ammonia: Ammonia (mg/L). Site is shaded if value is ≥ 0.025 mg/L.

T-N: Total Nitrogen (mg/L). Site is shaded if value is ≥ 2 mg/L

DOC: Dissolved Organic Carbon (mg/L). Site is shaded if value is ≥ 8.0 mg/L.

DO: Dissolved Oxygen (mg/L). Site is shaded if value is ≤ 5 mg/L.

Turbidity: Turbidity (NTUs). Site is shaded if value is ≥ 10 NTUs.

Table 4-1. (Continued)

<u>Physical Habitat Condition</u>

Riparian Buffer Width Left: Width of the riparian buffer on the left bank (meters). Site is shaded if value is < 10 m.

Riparian Buffer Width Right: Width of the riparian buffer on the right bank (meters). Site is shaded if value is < 10 m.

Adjacent Cover Left: Type of adjacent land cover on the left bank

Adjacent Cover Right: Type of adjacent land cover on the right bank

The following variables are scored on the following scale:

0-5	Poor
6-10	Marginal
11-15	Sub-optimal
16-20	Optimal

Sites are shaded if scores are $\leq$ 6.

Instream Habitat Structure: Scored based on the value of instream habitat to the fish community

Epifaunal Substrate: Scored based on the amount and variety of hard, stable substrates used by benthic macroinvertebrates

Velocity/Depth Diversity: Scored based on the variety of velocity/depth regimes present at a site

Pool/Glide/Eddy Quality: Scored based on the variety and complexity of slow or still water habitat present at a site

Riffle Run Quality: Scored based on the depth, complexity, and functionality of riffle/run habitat present at a site

Extent of Pools: The extent of pools, glides, and eddys present at a site (meters). Site is shaded if value is 0 m.

Extent of Riffles: The extent of riffles and runs present at a site (meters). Site is shaded if value is 0 m.

Embeddedness: Scored as a percentage (0-100) based on the fraction of surface area of larger particles surrounded by finer sediments. Site is shaded if value is 100%.

Shading: Scored as a percentage (0-100) based on estimates of the degree and duration of shading of sites during the summer. Site is shaded if value is 0%.

Trash Rating: Scored base on the visual appeal of the site and the presence/absence of human refuse. Site is shaded if value is $\leq$ 6.

Maximum Depth: Maximum depth of the stream (centimeters). Site is shaded if value is $\leq$ 20 cm.

<u>Physical Habitat Modifications</u>

Buffer Breaks?: Presence/absence of breaks in the riparian buffer, either right or left bank (Y/N). Site is shaded if value is Y.

Surface Mine?: Surface Mine present at the site (Y/N). Site is shaded if value is Y.

Landfill?: Landfill present at the site (Y/N). Site is shaded if value is Y.

Channelization: Stream channelization evident at the site (Y/N). Site is shaded if value is Y.

Erosion Severity Left - Severity of erosion on left bank (Severe, Moderate, Mild, or None). Site is shaded if value is Severe.

Erosion Severity Right - Severity of erosion on right bank. Site is shaded if value is Severe.

Bar Formation - Extent of bar formation in stream (Severe, Moderate, Mild, or None). Site is shaded if value is Severe

Table 4-1. (Continued)

Watershed Abbreviations		Cover Type Abbreviations	
ASSA	Assawoman Bay		
BALT	Baltimore Harbor	CP	Cropland
BODK	Bodkin Creek	DI	Dirt Road
CHIN	Chincoteague Bay	EM	Emergent Vegetation
DEER	Deer Creek	FR	Forest
DIVI	Dividing Creek	GR	Gravel Road
FURN	Furnace Bay	HO	Housing
GILB	Gilbert Swamp	LN	Mowed Lawn
ISLE	Isle of Wight Bay	LO	Logged Area
LIGU	Little Gunpowder Falls	OF	Old Field
NANT	Nanticoke River	OR	Orchard
NASS	Nassawango Creek	PA	Pasture
NEAS	Northeast River	PK	Parking Lot/Industrial/Commercial
NEWP	Newport Bay	PV	Paved Road
OXON	Oxon Creek	RR	Railroad
PAXM	Patuxent River Middle	SL	Bare Soil
PISC	Piscataway Creek	TG	Tall Grass
PRAL	Potomac River Allegany County		
PRUN	Potomac River Upper North Branch		
PRUT	Potomac River Upper Tidal		
SASS	Sassafras River		
SENE	Seneca Creek		
SIDE	Sideling Hill Creek		
SINE	Sinepuxent Bay		
STIL	Stillpond-Fairlee		
UPPC	Upper Pocomoke River		
WEBR	Western Branch		
YOUG	Youghiogheny River		
ZEKI	Zekiah Swamp		

MBSS Stream Waders - Volunteer Benthic Sampling Program

Introduction

Begun as a pilot during year 2000 of the MBSS sampling, Maryland Stream Waders is a statewide volunteer stream-monitoring program managed by DNR. Goals of Stream Waders are

- To increase the density of sampling sites for use in stream and watershed assessments;
- To improve stream stewardship ethics and encourage local action to improve watershed management;
- To educate the local community about the relationship between land use and stream quality; and
- To provide quality assured information on stream quality to state, local, and federal agencies, environmental organizations, and others.

Stream Waders data are intended for use in water quality reports (such as Maryland's biennial water quality report to Congress – the 305(b) Report), watershed restoration and protection programs, regulatory programs (such as 303(d) listing), and for local government use. They are also provided to the volunteers themselves who may have an interest in a particular stream or watershed.

Methods

Stream Waders is designed to be seamless with the MBSS and several other organizations, such as Montgomery County, who are performing stream sampling of benthos in Maryland. MBSS samples are collected at the watershed level (8-digit), while Stream Waders volunteers sample at the subwatershed (12-digit) level. Thus, Stream Waders data should help "fill the gaps" left in watershed areas not sampled by MBSS.

Each year, local governments and citizen organizations interested in the selected watersheds (the same watersheds chosen to be sampled that year by the core MBSS) are invited to submit site locations to be sampled by Stream Waders volunteers. For 2001, more than 150 sites were requested by local government agencies and citizen organizations. These pre-selected sites, along with others chosen to support DNR-supported programs (e.g., Watershed Restoration Action Strategies) were prioritized over others. For subwatersheds with few or no pre-selected sites, volunteers were asked to distribute additional sites throughout the subwatershed, with one site near the most downstream portion of the catchment. Most sites were either upstream of a road crossing or within an easy walk of a road. Volunteers selected 100-foot sections of stream for their samples. Each team of volunteers was given a GPS unit to record the latitude and longitude of the actual sampling sites.

A total of 170 volunteers were trained at four eight-hour training sessions in February 2001. For 2001, 29 watersheds were slated for sampling. Each of the 49 volunteer teams that formed during the training sessions were asked to select four subwatersheds and to sample five sites within each subwatershed. Volunteers sampled during the 1 March to 30 April spring index period.

Benthic macroinvertebrates were sampled using the same methods as MBSS biologists (Boward 2000 and Kazyak 2001). Samples were preserved in ethanol and organisms were subsampled (about 100 organisms per sample) and identified to family (Boward and Friedman 2000) by DNR staff at DNR's laboratory in Annapolis. From the list of organisms identified from each site, a family-level Index of Biotic Integrity (IBI) was calculated and each site was rated either Good (IBI 4-5) Fair (IBI 3-3.9) or Poor (IBI 1-2.9) (Stribling et al. 1998).

In addition to sampling benthos at each site, volunteers noted general information about each stream, such as width and depth, as well as a description of the surrounding land and potential problems.

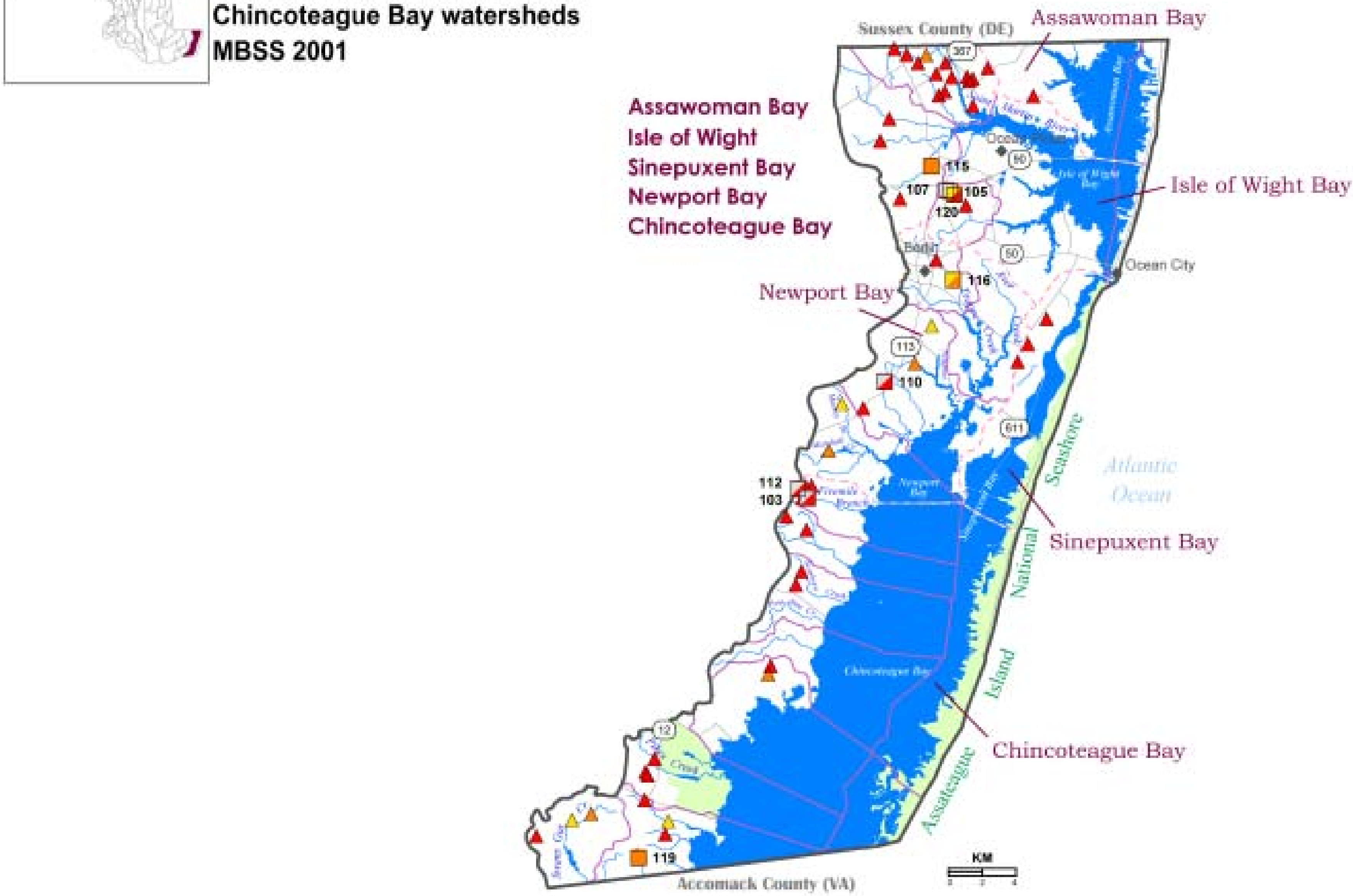
Results

In all, 708 sites in 29 8-digit watersheds were sampled during the 2001 Maryland Stream Waders Program. IBI results for these sites are included in the appropriate PSU summary located in this Chapter. A summary of those results, by MBSS PSU, is included in the following table.

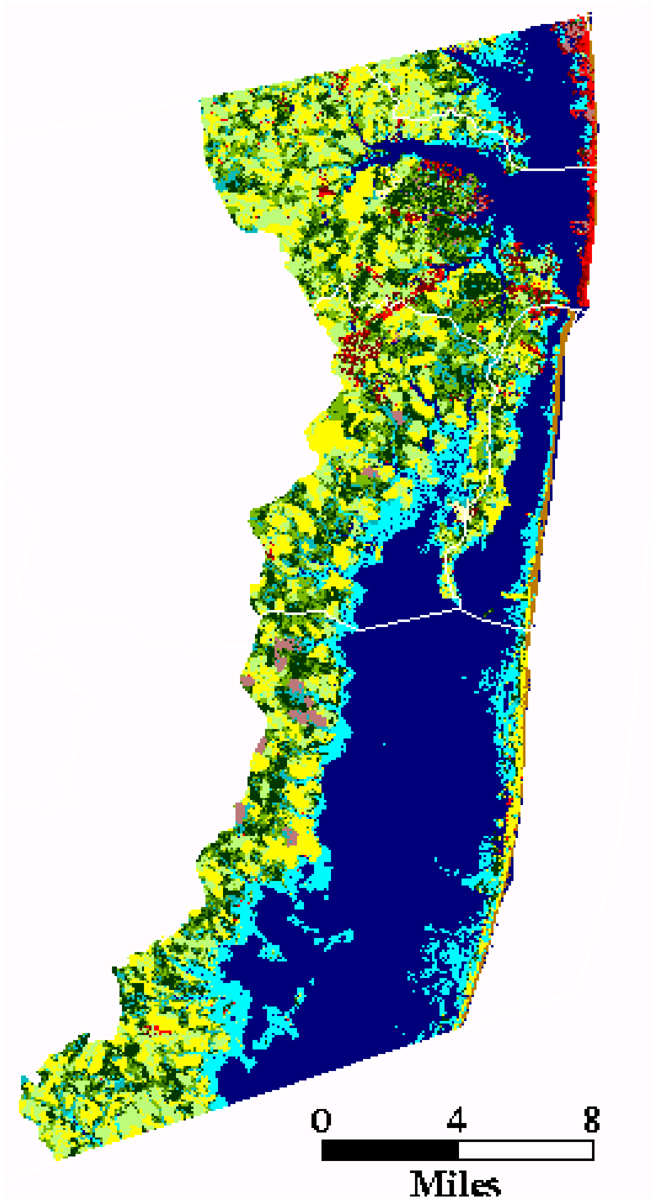
Summary of 2001 Stream Waders IBI Results

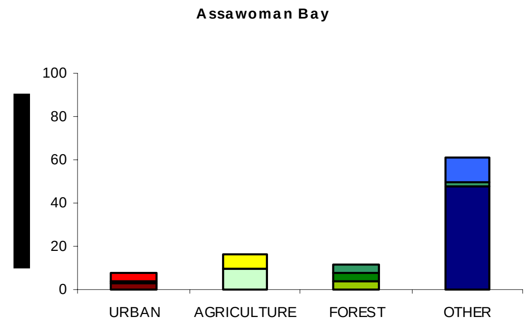
Primary Sampling Unit	Number of Stream Waders Sites	Summary
Assawoman Bay/Isle of Wight/ Sinepuxent Bay/Newport Bay/ Chincoteague Bay	41	Most sites were rated Very Poor, with some Fair and Poor ratings. There were no sites rated Good. Stream Waders results generally agreed with those of MBSS. For example, ratings within the cluster of MBSS and Stream Waders sites in the Fivemile Branch subwatershed agree.
BodkinCreek/Baltimore Harbor	26	Most sites were rated Very Poor, with some Poor. There were no sites rated Fair or Good. Stream Waders results generally agreed with those of MBSS, especially those rated Very Poor in the Marley Creek drainage.
Deer Creek	60	Most sites were rated Good or Fair by Stream Waders. Only one site was rated Very Poor. Several sites in the Rocks and Susquehanna State Park areas were rated Good by both Stream Waders and MBSS.
Dividing Creek/Nassawango Creek	28	Most sites were rated Poor or Very Poor, with no sties rated Good. Pairs of Stream Waders and MBSS sites on Tonys Creek and Pusey Branch rated each section of stream similarly (Very Poor).
Gilbert Swamp	39	Most Stream Waders sites were rated either Fair or Good. Stream Waders results generally agreed with those of MBSS.
Little Gunpowder Falls	18	Most sites were rated either Fair or Good, with most good sites situated near Gunpowder Falls State Park. Only one site was rated Very Poor. Stream Waders results generally agreed with those of MBSS.
Nanticoke River	51	Most sites were rated Very Poor or Poor; none were rated Good. Stream Waders results generally agreed with those of MBSS.
Northeast River/Furnace Bay	33	Most sites were rated Fair or Poor. A few were rated either Good or Very Poor. Stream Waders results generally agreed with those of MBSS. Note the cluster of sites (MBSS and Stream Waders) rated Good near the confluence of Little North East Branch and West Branch.
Patuxent River Middle	24	Only one site, on Wilson Owens Branch, was rated Good. Most were rated Very Poor or Fair. Neither MBSS or Stream Waders sites did not rate better in the Patuxent River Park area, as may have been expected.
Piscataway Creek	18	Most good sites were in the southern portion of the watershed and in L.F. Cosca Regional Park, while several Very Poor sites were situated in the upper portion of Piscataway Creek. Stream Waders generally agreed with those of MBSS.
Potomac River Alleghany County/ Sideling Hill Creek	57	Most sites rated Good were in the Sideling Hill Creek drainage and the Potomac River direct drainage to the east. Twenty-one samples were collected by Ridge and Valley Stream Keepers volunteers in the Sideling Hill Creek drainage alone generally agreed with MBSS scores.
Potomac River Upper North Branch	5	The two sites rated Good were in the eastern portion of the PSU, other sites were rated Fair or Poor.
Sassafras River/Stillpond-Fairlee	33	Most sites were rated either Very Poor or Poor. No sites were rated Good. Stream Waders ratings were generally lower than those from MBSS samples.
Seneca Creek	64	Most sites were rated Very Poor or Poor, including most of those in Seneca Creek State Park. Only four sites were rated Good. Stream Waders and MBSS results were comparable where sites were close together.
Upper Pocomoke River	28	Most sites were rated Very Poor. No sites were rated Good or Fair. Stream Waders ratings were generally rated lower than those of MBSS. Stream Waders and MBSS results were comparable where sites were close to one another, for example, in Old Mill Branch.
Western Branch	57	Most sites were rated Poor or Very Poor. Stream Waders samples were generally rated lower than MBSS samples.
Youghiogheny River	26	Most sites were rated Good or Fair. Only one site was rated Very Poor. Stream Waders results compared well with those from MBSS samples.
Zekiah Swamp	69	Most sites were rated Good or Fair. These sites were mostly in the lower portion of the watershed. Most MBSS sites were also rated either Good or Fair.

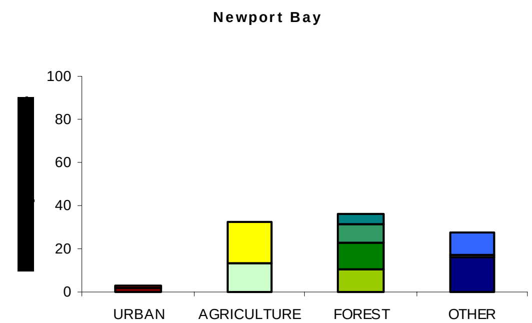
Assawoman Bay\ Isle of Wight Bay\ Sinepuxent Bay\ Newport Bay\ Chincoteague Bay watersheds MBSS 2001

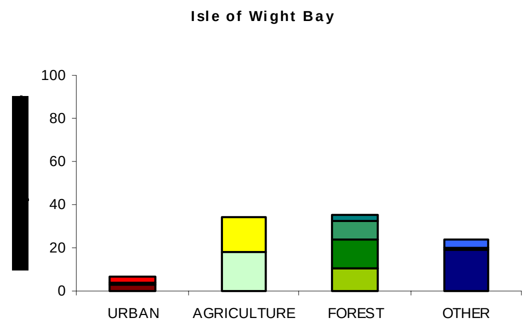


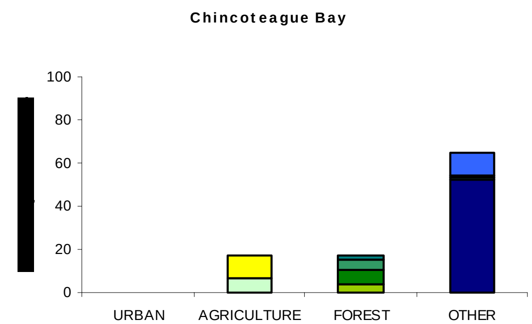
Assawoman/Isle of Wight/Sinepuxent/Newport/ Chincoteague Bays

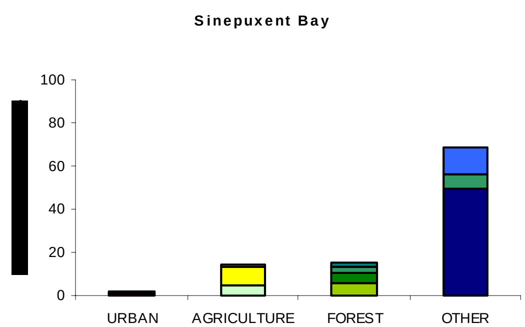












Assawoman/Isle of Wight/Sinepuxent/Newport/Chincoteague Bays

Site Information

Site	Stream Name	12-Digit Subwatershed Code	8-digit Watershed	Basin	County	Date Sampled Spring	Date Sampled Summer	Order	Catchment Area (acres)
CHIN-103-R-2001	WATERWORKS CR	021301060680	Chincoteague Bay	OCEAN COASTAL	Worcester	13-Mar-01	13-Jun-01	1	108
CHIN-112-R-2001	FIVEMILE BR	021301060680	Chincoteague Bay	OCEAN COASTAL	Worcester	14-Mar-01	13-Jun-01	1	6
CHIN-119-R-2001	POWELL CR	021301060671	Chincoteague Bay	OCEAN COASTAL	Worcester	08-Mar-01	6-Jun-01	1	473
ISLE-105-R-2001	CRIPPEN BR	021301030690	Isle of Wight Bay	OCEAN COASTAL	Worcester	09-Mar-01	11-Jun-01	1	284
ISLE-107-R-2001	CRIPPEN BR	021301030690	Isle of Wight Bay	OCEAN COASTAL	Worcester	09-Mar-01	11-Jun-01	1	54
ISLE-115-R-2001	CHURCH BR	021301030691	Isle of Wight Bay	OCEAN COASTAL	Worcester	09-Mar-01	11-Jun-01	1	2644
ISLE-120-R-2001	CRIPPEN BR	021301030690	Isle of Wight Bay	OCEAN COASTAL	Worcester	09-Mar-01	11-Jun-01	1	361
NEWP-110-R-2001	TUKESBURG BR	021301050683	Newport Bay	OCEAN COASTAL	Worcester	13-Mar-01	25-Jul-01	1	272
NEWP-116-R-2001	KITTS BR	021301050685	Newport Bay	OCEAN COASTAL	Worcester	09-Mar-01	18-Jun-01	1	2078

Indicator Information

Site	FIBI	BIBI	PHI	Brook Trout Present	Black Water Stream
CHIN-103-R-2001	NR	1.57	54.58	0	1
CHIN-112-R-2001	NS	1.00	NS	NS	NS
CHIN-119-R-2001	2.25	2.71	32.76	0	0
ISLE-105-R-2001	NR	1.57	33.98	0	0
ISLE-107-R-2001	NR	1.57	24.07	0	0
ISLE-115-R-2001	2.75	2.71	83.87	0	0
ISLE-120-R-2001	3.25	1.86	39.87	0	0
NEWP-110-R-2001	NS	1.29	NS	NS	NS
NEWP-116-R-2001	3.00	2.71	61.54	0	0

Catchment Land Use Information

Site	Percent Urban	Percent Agriculture	Percent Forest	Percent Other	Percent Impervious Surface
CHIN-103-R-2001	0.00	52.91	47.09	0.00	0.00
CHIN-112-R-2001	0.00	0.00	100.00	0.00	0.00
CHIN-119-R-2001	0.00	57.50	42.37	0.13	0.00
ISLE-105-R-2001	7.59	68.64	23.55	0.22	2.96
ISLE-107-R-2001	0.00	81.93	18.07	0.00	0.00
ISLE-115-R-2001	0.37	50.11	49.00	0.52	0.25
ISLE-120-R-2001	6.04	57.71	36.08	0.18	2.39
NEWP-110-R-2001	0.12	63.21	35.99	0.69	0.03
NEWP-116-R-2001	14.93	48.70	33.85	2.53	6.42

Interpretation of Watershed Condition

- Many streams are channelized, straight ditches with very little flow
- Site112 has very low pH and ANC
- Effluent from a landfill flows into site 116
- Chloride, nitrogen, and phosphorus levels are elevated at most sites
- High dissolved organic carbon levels may be indicative of natural, swampy conditions

Assawoman/Isle of Wight/Sinepuxent/Newport/Chincoteague Bays

Water Chemistry Information

Site	Closed pH	Specific Cond.	ANC (µeq/L)	Cl (mg/L)	Nitrate-N (mg/L)	SO4 (mg/L)	T-P (mg/L)	Ortho-P (mg/L)	Nitrite (mg/L)	Ammonia (mg/L)	T-N (mg/L)	DOC (mg/L)	DO (mg/L)	Turbidity (mg/L)
CHIN-103-R-2001	5.93	143.3	139.8	19.941	0.310	16.894	0.4729	0.375	0.0057	0.024	1.163	19.903	3.9	4.6
CHIN-112-R-2001	4.39	87.1	-43.8	11.955	0.102	6.495	0.0169	0.001	0.0050	0.023	0.689	32.635	NS	NS
CHIN-119-R-2001	6.59	203.6	300.1	24.384	1.636	23.623	0.0586	0.033	0.0083	0.065	2.103	8.804	5.5	8.9
ISLE-105-R-2001	6.38	310.2	339.9	41.493	3.067	29.174	0.0601	0.044	0.0087	0.017	3.570	6.851	6.7	6.3
ISLE-107-R-2001	7.08	340.1	327.1	46.928	3.880	34.493	0.0913	0.067	0.0133	0.012	4.358	7.143	6.8	9.1
ISLE-115-R-2001	6.48	131.6	232.5	22.110	0.755	18.705	0.0754	0.039	0.0037	0.023	1.312	9.760	5.7	7
ISLE-120-R-2001	6.37	282.2	311.2	40.656	2.535	27.288	0.0550	0.026	0.0076	0.016	3.055	6.826	6.7	57.8
NEWP-110-R-2001	6.49	178.7	248.0	21.556	1.492	20.968	0.0284	0.008	0.0064	0.019	1.889	8.961	NS	NS
NEWP-116-R-2001	7.75	579.4	748.5	102.940	6.173	23.730	1.5152	1.205	0.0593	2.562	9.643	7.120	7.7	6.1

Physical Habitat Condition

Site	Riparian Buffer Width Left	Riparian Buffer Width Right	Adjacent Cover Left	Adjacent Cover Right	Instream Habitat Structure	Epifaunal Substrate	Velocity/ Depth Diversity	Pool/ Glide/ Eddy Quality	Extent of Pools (m)	Riffle/Run Quality	Extent of Riffles (m)	Embedded-ness	Shading	Trash Rating	Maximum Depth (cm)
CHIN-103-R-2001	0	0	CP	CP	9	3	9	15	59	6	16	100	5	18	57
CHIN-112-R-2001	50	50	FR	FR	NS	NS	NS	NS	NS	NS	NS	NS	NS	19	NS
CHIN-119-R-2001	18	50	CP	FR	14	10	6	8	70	7	10	100	93	17	30
ISLE-105-R-2001	50	50	FR	FR	17	17	9	9	30	15	50	20	96	18	38
ISLE-107-R-2001	50	3	OF	DI	7	7	7	7	47	11	30	40	80	16	37
ISLE-115-R-2001	50	50	FR	FR	15	17	8	7	8	15	71	18	95	17	24
ISLE-120-R-2001	50	50	FR	FR	10	10	8	9	33	10	42	45	75	19	35
NEWP-110-R-2001	50	50	FR	FR	11	12	7	7	39	11	40	28	92	18	49
NEWP-116-R-2001	50	50	FR	FR	15	17	7	7	6	13	71	20	89	16	30

Physical Habitat Modifications

Site	Buffer Breaks?	Surface Mine?	Landfill?	Channelization?	Erosion Severity Left	Erosion Severity Right	Bar Formation
CHIN-103-R-2001	Y	N	N	Y	Severe	Severe	Severe
CHIN-112-R-2001	N	N	N	Y	NS	NS	NS
CHIN-119-R-2001	N	N	N	N	Mild	Mild	Moderate
ISLE-105-R-2001	N	N	N	Y	None	None	None
ISLE-107-R-2001	Y	N	N	Y	None	None	None
ISLE-115-R-2001	N	N	N	N	Moderate	Moderate	Severe
ISLE-120-R-2001	N	N	N	Y	None	None	None
NEWP-110-R-2001	N	N	N	N	NS	NS	NS
NEWP-116-R-2001	N	N	N	Y	None	None	Minor

Assawoman/Isle of Wight/Sinepuxent/Newport/Chincoteague Bays

Stream Waders Data

Site	8-Digit Watershed	12-Digit Subwatershed	Stream Name	Benthic IBI
0689-3	Assawoman Bay	021301020689		1.29
0674-1	Chincoteague Bay	021301060674		1.57
0680-5	Chincoteague Bay	021301060680		1.57
0679-2	Chincoteague Bay	021301060679		1.86
0671-2	Chincoteague Bay	021301060671	RILEY CR	1.00
0672-2	Chincoteague Bay	021301060672	LITTLE MILL CR	2.14
0680-4	Chincoteague Bay	021301060680		1.86
0672-3	Chincoteague Bay	021301060672	PARADIE BR	3.57
0674-3	Chincoteague Bay	021301060674	PIKES CR	1.57
0680-2	Chincoteague Bay	021301060680		1.29
0680-3	Chincoteague Bay	021301060680		1.00
0678-5	Chincoteague Bay	021301060678	SCARBORO CR	1.00
0678-4	Chincoteague Bay	021301060678		1.29
0671-5	Chincoteague Bay	021301060671	HANCOCK CR	1.86
0671-3	Chincoteague Bay	021301060671	RILEY CR	3.57
0672-1	Chincoteague Bay	021301060672	MARSHALL DITCH	1.29
0679-1	Chincoteague Bay	021301060679		1.29
0675-1	Chincoteague Bay	021301060675	BRIMER GUT	2.43
0671-4	Chincoteague Bay	021301060671	POWELL CR	2.14
0675-2	Chincoteague Bay	021301060675	BRIMER GUT	1.57
0674-2	Chincoteague Bay	021301060674		1.57
0692-14	Isle of Wight Bay	021301030692	GODFREY AGRICULTURAL DITCH	1.29
0692-13	Isle of Wight Bay	021301030692		1.00
0692-11	Isle of Wight Bay	021301030692	MOSES CR	1.57
0692-8	Isle of Wight Bay	021301030692	LAMBKIWS CR	1.57
0692-7	Isle of Wight Bay	021301030692	LAMBARKINS BR	1.57
0692-6	Isle of Wight Bay	021301030692		1.29
0690-2	Isle of Wight Bay	021301030690	CRIPPEN BR	1.86
0692-5	Isle of Wight Bay	021301030692	SLAB BRIDGE PRONG	1.86
0692-2	Isle of Wight Bay	021301030692	CAREY BR	1.00
0692-12	Isle of Wight Bay	021301030692	PERKINS CR	1.57
0692-9	Isle of Wight Bay	021301030692		1.57
0692-3	Isle of Wight Bay	021301030692	CAREY BR	2.71
0692-4	Isle of Wight Bay	021301030692		1.57
0692-1	Isle of Wight Bay	021301030692	CAREY BR	1.29
0691-7	Isle of Wight Bay	021301030691	CHURCH BR	1.57
0691-1	Isle of Wight Bay	021301030691	BIRCH BR	1.29
0691-4	Isle of Wight Bay	021301030691	MIDDLE BR	1.86
0692-10	Isle of Wight Bay	021301030692		1.86
0685-1	Newport Bay	021301050685		1.57
0682-1	Newport Bay	021301050682	MASSEY BRANCH	3.29
0682-2	Newport Bay	021301050682		2.43
0683-1	Newport Bay	021301050683		3.00
0683-2	Newport Bay	021301050683		2.14
0683-3	Newport Bay	021301050683		1.57
0681-1	Sinepuxent Bay	021301040681		1.57
0681-3	Sinepuxent Bay	021301040681		1.29
0681-2	Sinepuxent Bay	021301040681		1.29

Assawoman/Isle of Wight/Sinepuxent/Newport/Chincoteague Bays

Fish Species Present

AMERICAN EEL
BANDED KILLIFISH
BLUEGILL
BLUESPOTTED SUNFISH
CREEK CHUBSUCKER
EASTERN MUDMINNOW
GOLDEN SHINER
INLAND SILVERSIDE
LARGEMOUTH BASS
MOSQUITOFISH
PIRATE PERCH
PUMPKINSEED
REDFIN PICKEREL

Exotic Plants Present

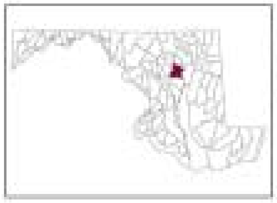
JAPANESE HONEYSUCKLE
MULTIFLORA ROSE

Benthic Taxa Present

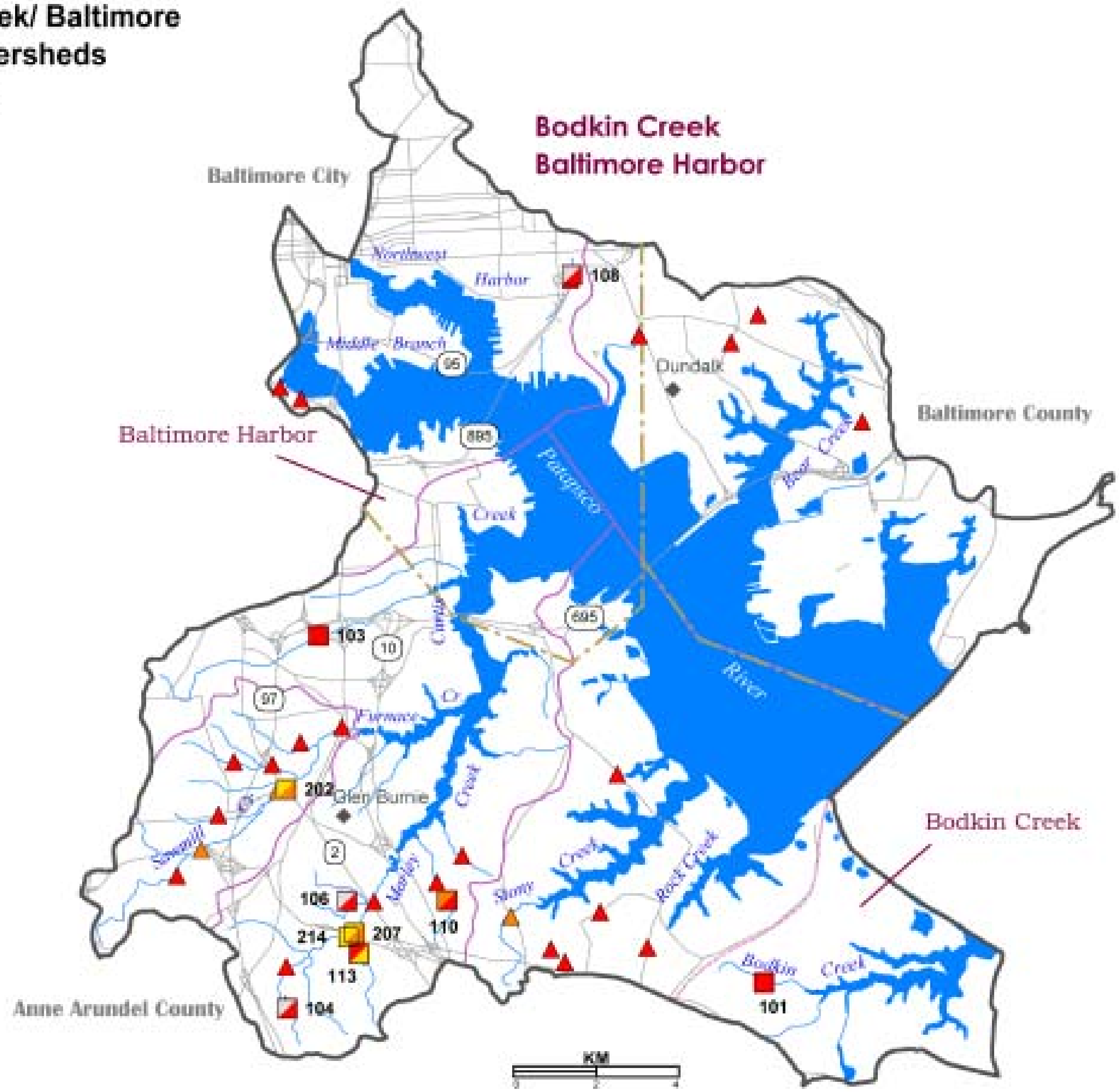
ATRICHOPOGON
BEZZIA
CAECIDOTEA
CHAULIODES
CHEUMATOPSYCHE
CHIRONOMINI
CHIRONOMUS
CHRYSOPS
CNEPHIA
CONCHAPELOPIA
CORYNONEURA
CRANGONYX
CRICOTOPUS
CRICOTOPUS/ORTHOCLADIUS
CRYPTOCHIRONOMUS
CULICOIDES
DICROTENDIPES
DIPLOCLADIUS
DUBIRAPHIA
DUGESIA
ENCHYTRAEIDAE
ENCHYTRAEIDAE
ENDOCHIRONOMUS
GAMMARUS
GLYPTOTENDIPES
HABROPHLEBIA
HETEROTRISSOCLADIUS
HYDROBAENUS
HYDROPORUS
IRONOQUIA
ISOTOMIDAE
ISOTOMURUS
LEPTOPHLEBIIDAE
LIBELLULIDAE
LIMNEPHILIDAE
LIMNODRILUS
LIMNOPHYES
LUMBRICULIDAE
LYPE
MENETUS
MEROPELOPIA
MESOCRICOTOPUS
MICROTENDIPES
MUSCULIUM
NAIDIDAE
NYCTIOPHYLAX
ORTHOCLADIINAE
ORTHOCLADIUS
PARALEPTOPHLEBIA
PARAMETRIOCNEMUS
PARATANYTARSUS
PELTODYTES
PHAENOPSECTRA
PHYSELLA
PLATYCENTROPUS
POLYPEDILUM
PROCAMBARUS
PROCLADIUS
PROSIMULIUM
PROSTOMA
PSEUDOLIMNOPHILA
PSYCHODIDAE
PTILOSTOMIS
RHEOCRICOTOPUS
SIMULIIDAE
SIMULIUM
SPHAERIIDAE
SPHAERIUM
STAGNICOLA
STEGOPTERNA
STENELMIS
SYMPOTTHASTIA
SYNURELLA
TANYPODINAE
TANYTARSINI
TANYTARSUS
THIENEMANNIMYIA GROUP
TRIBELOS
TUBIFICIDAE
ZAVRELIMYIA

Herpetofauna Present

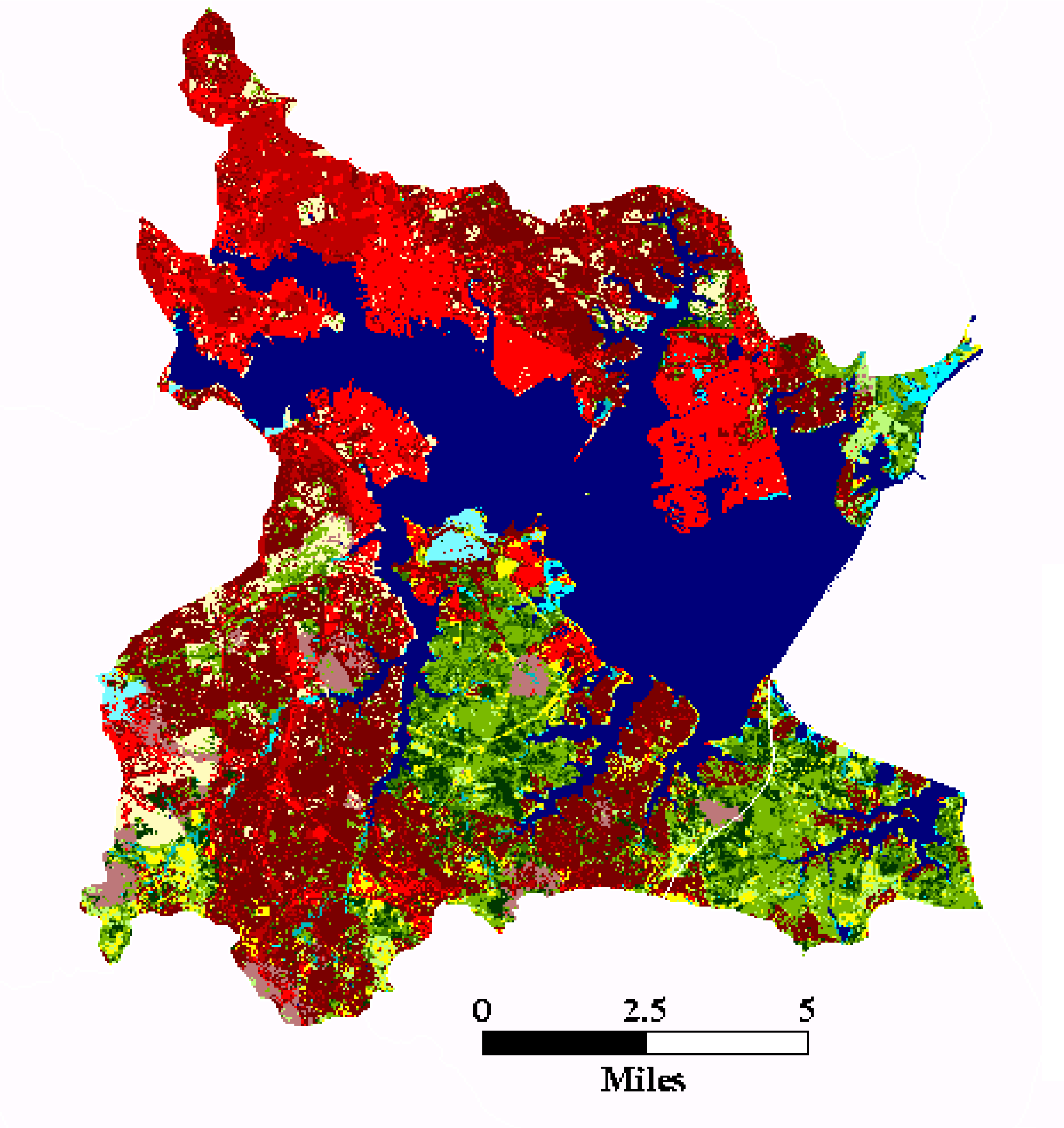
BULLFROG
COMMON SNAPPING TURTLE
EASTERN PAINTED TURTLE
FOWLER'S TOAD
GREEN FROG
NORTHERN WATER SNAKE
SOUTHERN LEOPARD FROG

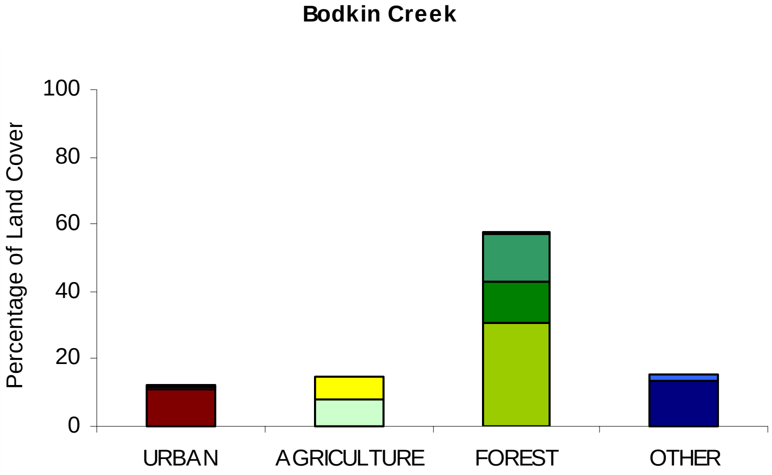


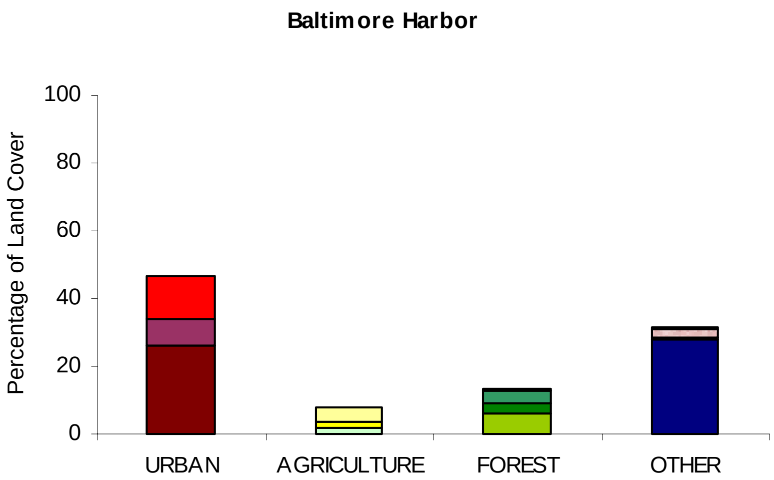
Bodkin Creek/ Baltimore Harbor watersheds MBSS 2001



Bodkin Creek/Baltimore Harbor







Bodkin Creek/Baltimore Harbor

Site Information

Site	Stream Name	12-Digit Subwatershed Code	8-digit Watershed	Basin	County	Date Sampled Spring	Date Sampled Summer	Order	Catchment Area (acres)
BALT-103-R-2001	CABIN BR UT1	021309031008	Baltimore Harbor	PATAPSCO RIVER	Anne Arundel	02-Mar-01	5-Jun-01	1	1786
BALT-104-R-2001	MARLEY CK	021309031008	Baltimore Harbor	PATAPSCO RIVER	Anne Arundel	01-Mar-01	1-Jun-01	1	135
BALT-106-R-2001	MARLEY CK UT3	021309031008	Baltimore Harbor	PATAPSCO RIVER	Anne Arundel	01-Mar-01	1-Jun-01	1	232
BALT-108-R-2001	NORTHWEST HARBOR UT1	021309031010	Baltimore Harbor	PATAPSCO RIVER	Anne Arundel	02-Mar-01	5-Jun-01	1	147
BALT-110-R-2001	MARLEY CREEK UT5	021309031008	Baltimore Harbor	PATAPSCO RIVER	Anne Arundel	01-Mar-01	1-Jun-01	1	670
BALT-113-R-2001	MARLEY CREEK UT2	021309031008	Baltimore Harbor	PATAPSCO RIVER	Anne Arundel	02-Mar-01	1-Jun-01	1	862
BALT-202-R-2001	SAWMILL CR	021309031009	Baltimore Harbor	PATAPSCO RIVER	Anne Arundel	02-Mar-01	10-Jul-01	2	3269
BALT-207-R-2001	MARLEY CR	021309031008	Baltimore Harbor	PATAPSCO RIVER	Anne Arundel	01-Mar-01	25-Jul-01	2	3166
BALT-214-R-2001	MARLEY CR	021309031008	Baltimore Harbor	PATAPSCO RIVER	Baltimore County	09-Mar-01	25-Jul-01	2	2170
BODK-101-R-2001	MAIN CR UT1	021309021000	Bodkin Creek	PATAPSCO RIVER	Baltimore County	01-Mar-01	5-Jun-01	1	796

Indicator Information

Site	FIBI	BIBI	PHI	Brook Trout Present	Black Water Stream
BALT-103-R-2001	1.00	1.00	1.14	0	0
BALT-104-R-2001	NR	1.29	5.27	0	0
BALT-106-R-2001	NR	1.00	7.19	0	0
BALT-108-R-2001	NR	1.57	70.40	0	0
BALT-110-R-2001	2.00	1.86	43.35	0	0
BALT-113-R-2001	1.75	3.57	45.25	0	0
BALT-202-R-2001	3.75	2.43	74.36	0	0
BALT-207-R-2001	3.25	2.43	85.44	0	0
BALT-214-R-2001	3.75	3.00	73.94	0	0
BODK-101-R-2001	1.50	1.29	10.53	0	0

Catchment Land Use Information

Site	Percent Urban	Percent Agriculture	Percent Forest	Percent Other	Percent Impervious Surface
BALT-103-R-2001	58.69	12.45	15.40	13.47	20.26
BALT-104-R-2001	73.43	10.26	6.06	10.26	24.07
BALT-106-R-2001	85.91	4.61	9.35	0.14	28.59
BALT-108-R-2001	83.41	13.79	2.59	0.22	41.22
BALT-110-R-2001	81.79	5.16	12.90	0.14	31.64
BALT-113-R-2001	41.54	27.15	31.24	0.07	15.06
BALT-202-R-2001	31.50	30.38	27.38	10.75	11.52
BALT-207-R-2001	64.78	12.59	16.76	5.86	23.44
BALT-214-R-2001	74.13	7.33	10.19	8.36	27.11
BODK-101-R-2001	7.62	19.14	69.57	3.67	2.16

Interpretation of Watershed Condition

- Channelization a major problem, sites 103 and 207 run under major highways
- Major signs of human disturbance (trash), site 202 has oil leaking into the stream from a fuel company
- Very high urban land use at almost all sites
- Nitrogen and phosporous elevated at many sites
- Several sites highly turbid, or with very low dissolved oxygen levels

Bodkin Creek/Baltimore Harbor

Water Chemistry Information

Site	Closed pH	Specific Cond.	ANC (µeq/L)	Cl (mg/L)	Nitrate-N (mg/L)	SO4 (mg/L)	T-P (mg/L)	Ortho-P (mg/L)	Nitrite (mg/L)	Ammonia (mg/L)	T-N (mg/L)	DOC (mg/L)	DO (mg/L)	Turbidity (mg/L)
BALT-103-R-2001	7.61	4076.6	1097.0	1195.365	0.510	20.870	0.0310	0.031	0.0104	0.003	0.853	3.326	0.3	3.1
BALT-104-R-2001	6.02	1018.4	324.1	268.983	0.095	21.338	0.0140	0.004	0.0013	0.037	0.306	4.485	0.9	6.9
BALT-106-R-2001	6.92	703.9	1097.6	146.861	1.626	33.750	0.0202	0.009	0.0179	0.238	2.388	5.572	8.6	18.1
BALT-108-R-2001	7.85	1168.4	1548.4	268.483	1.755	36.802	0.0194	0.001	0.0196	0.040	2.303	2.292	6.3	4.9
BALT-110-R-2001	6.96	571.2	619.2	118.816	0.409	33.119	0.0180	0.010	0.0047	0.093	0.721	5.771	7.4	8.8
BALT-113-R-2001	7.00	350.7	385.1	64.223	0.981	25.094	0.0167	0.005	0.0074	0.088	1.385	5.473	8.3	12.6
BALT-202-R-2001	6.80	524.2	332.2	119.869	1.254	23.473	0.0157	0.005	0.0032	0.052	1.624	1.893	7	10.8
BALT-207-R-2001	6.75	421.1	431.0	89.913	1.254	16.445	0.0143	0.001	0.0054	0.059	1.571	3.223	4	12.4
BALT-214-R-2001	6.70	330.9	418.0	63.029	1.417	14.987	0.0131	0.007	0.0045	0.030	1.795	2.627	4.5	15.1
BODK-101-R-2001	5.30	1390.3	101.9	313.246	0.001	13.941	0.0252	0.002	0.0018	0.314	0.455	2.479	5.2	11.9

Physical Habitat Condition

Site	Riparian Buffer Width Left	Riparian Buffer Width Right	Adjacent Cover Left	Adjacent Cover Right	Instream Habitat Structure	Epifaunal Substrate	Velocity/ Depth Diversity	Pool/ Glide/ Eddy Quality	Extent of Pools (m)	Riffle/ Run Quality	Extent of Riffles (m)	Embedded-ness	Shad-ing	Trash Rating	Maximum Depth (cm)
BALT-103-R-2001	0	0	PV	PV	0	0	1	2	75	0	0	100	99	2	15
BALT-104-R-2001	50	50	LN	LN	4	2	2	6	75	6	1	100	90	8	38
BALT-106-R-2001	50	50	LN	LN	1	1	6	1	50	9	28	0	70	7	13
BALT-108-R-2001	15	50	PV	GR	16	13	13	14	38	15	40	55	85	1	59
BALT-110-R-2001	50	50	LN	FR	6	4	11	11	70	7	12	70	70	9	81
BALT-113-R-2001	50	50	FR	FR	7	11	12	11	63	12	79	75	90	13	53
BALT-202-R-2001	0	10	PV	PV	14	13	13	14	62	15	16	55	75	3	87
BALT-207-R-2001	50	50	FR	FR	11	10	13	16	67	12	8	50	68	8	131
BALT-214-R-2001	50	40	LN	PV	14	6	6	17	75	0	0	100	97	8	145
BODK-101-R-2001	50	45	FR	PK	6	5	5	9	60	6	16	100	90	7	31

Physical Habitat Modifications

Site	Buffer Breaks?	Surface Mine?	Landfill?	Channelization?	Erosion Severity Left	Erosion Severity Right	Bar Formation
BALT-103-R-2001	Y	N	N	Y	Mild	None	Minor
BALT-104-R-2001	N	N	N	N	Moderate	Moderate	Minor
BALT-106-R-2001	Y	N	N	Y	None	None	None
BALT-108-R-2001	Y	N	N	Y	Mild	Mild	Minor
BALT-110-R-2001	N	N	N	N	Moderate	Severe	Minor
BALT-113-R-2001	N	N	N	N	Severe	Severe	Moderate
BALT-202-R-2001	Y	N	N	Y	Mild	Mild	None
BALT-207-R-2001	Y	N	N	Y	Mild	Mild	None
BALT-214-R-2001	N	N	N	N	Moderate	Moderate	None
BODK-101-R-2001	Y	N	N	N	Mild	Mild	Minor

Bodkin Creek/Baltimore Harbor

Stream Waders Data

Site	8-Digit Watershed	12-Digit Subwatershed	Stream Name	Benthic IBI
1006-5	Baltimore Harbor	021309031006	BRADY COVE UT	1.86
1007-4	Baltimore Harbor	021309031007	BEAR CR UT	1.57
1007-3	Baltimore Harbor	021309031007	LYNCH CR	1.29
1010-1	Baltimore Harbor	021309031010		1.00
1006-4	Baltimore Harbor	021309031006	ELK COVE UT	1.86
1006-1	Baltimore Harbor	021309031006	COX CR UT	1.29
1007-5	Baltimore Harbor	021309031007		1.57
1006-3	Baltimore Harbor	021309031006	ELK COVE UT	1.00
1007-2	Baltimore Harbor	021309031007	COLGATE CR	1.00
1006-2	Baltimore Harbor	021309031006	STONEY CR	2.43
1006-6	Baltimore Harbor	021309031006	UPPER ROCK CR UT	1.57
1009-1	Baltimore Harbor	021309031009	SAWMILL CR	1.57
1008-2	Baltimore Harbor	021309031008	MARLEY CR UT	1.29
1008-3	Baltimore Harbor	021309031008	MARLEY CR UT	1.57
1008-1	Baltimore Harbor	021309031008	MARLEY CR	1.57
1008-4	Baltimore Harbor	021309031008	MARLEY CR UT	1.57
1009-8	Baltimore Harbor	021309031009	SAWMILL CR	1.57
1010-4	Baltimore Harbor	021309031010	PATAPSCO R UT	1.29
1009-9	Baltimore Harbor	021309031009	SAWMILL CR UT	1.57
1009-5	Baltimore Harbor	021309031009	SAWMILL CR	2.14
1008-5	Baltimore Harbor	021309031008		1.57
1010-3	Baltimore Harbor	021309031010	MIDDLE BR UT	1.00
1009-4	Baltimore Harbor	021309031009	MUDDY BRIDGE BR	1.86
1009-7	Baltimore Harbor	021309031009	SAWMILL CR	1.57
1009-3	Baltimore Harbor	021309031009	SAWMILL CR UT	1.86
1009-2	Baltimore Harbor	021309031009	SAWMILL CR	2.43

Bodkin Creek/Baltimore Harbor

Fish Species Present

AMERICAN EEL
BLACKNOSE DACE
BLUEGILL
BLUESPOTTED SUNFISH
BROWN BULLHEAD
CHAIN PICKEREL
CREEK CHUBSUCKER
EASTERN MUDMINNOW
GOLDEN SHINER
GOLDFISH
LARGEMOUTH BASS
LEAST BROOK LAMPREY
MOSQUITOFISH
PUMPKINSEED
REDBREAST SUNFISH
REDFIN PICKEREL
TESSELLATED DARTER
WHITE SUCKER
YELLOW PERCH

Exotic Plants Present

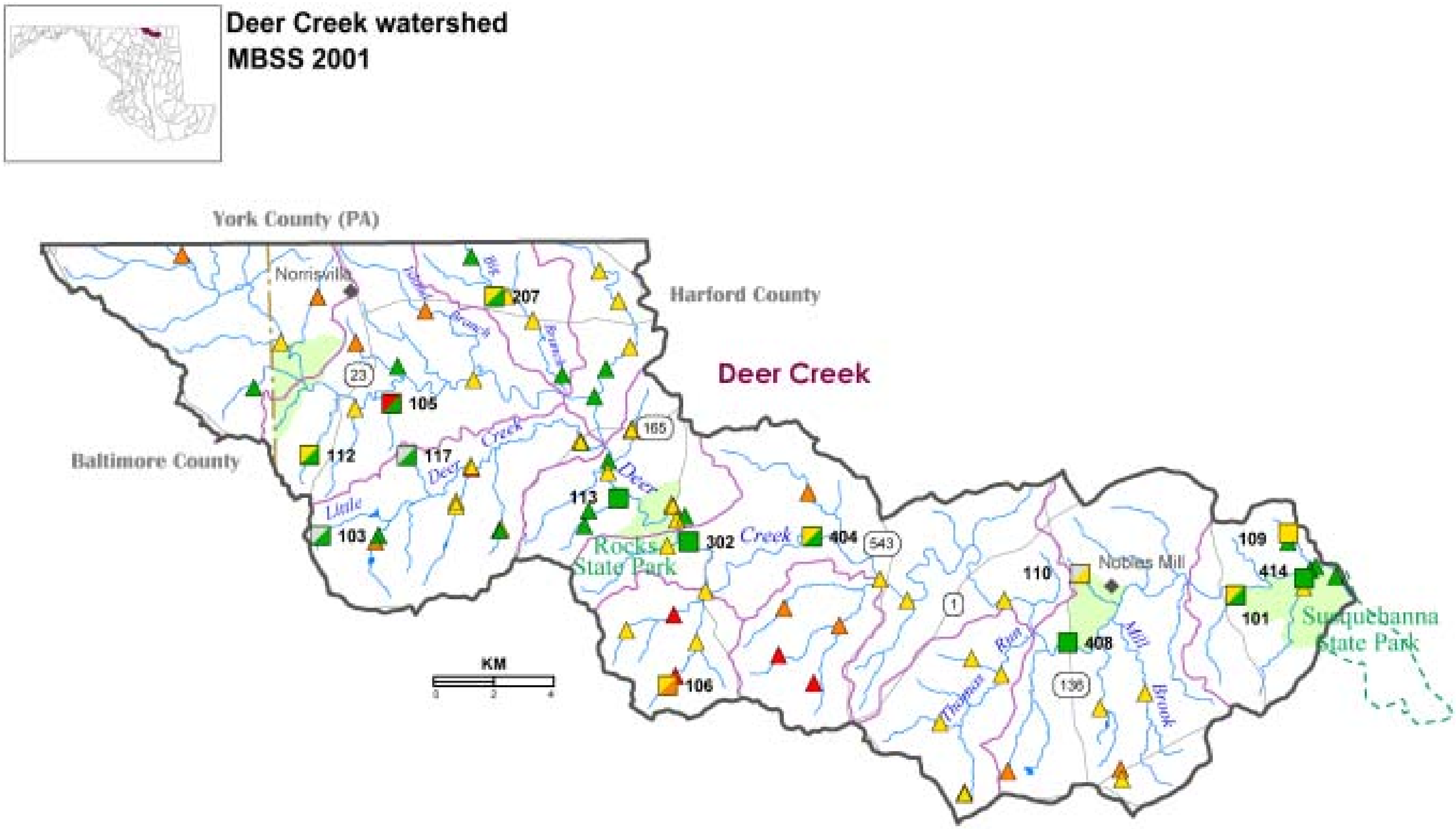
JAPANESE HONEYSUCKLE
MICROSTEGIUM
MILE-A-MINUTE
MULTIFLORA ROSE
PHRAGMITES
THISTLE

Benthic Taxa Present

ABLABESMYIA
ACILIUS
AGABUS
ALOTANYPUS
ANCYRONYX
APSECTROTANYPUS
ARGIA
BITTACOMORPHA
BOYERIA
BRILLIA
BUENO
CAECIDOTEA
CALOPTERYX
CHEUMATOPSYCHE
CHIRONOMUS
CLINOTANYPUS
COENAGRIONIDAE
COLLEMBOLA
CONCHAPELOPIA
CORIXIDAE
CORYNONEURA
CRICOTOPUS/ORTHOCLADIUS
CRYPTOCHIRONOMUS
CULICOIDES
DICROTENDIPES
DIPLOCLADIUS
DUBIRAPHIA
EMPIDIDAE
ENALLAGMA
ENCHYTRAEIDAE
ENDOCHIRONOMUS
EURYLOPHELLA
GAMMARUS
GYRINUS
HELICHUS
HEMERODROMIA
HYALELLA
HYDROPORUS
HYDROPSYCHE
ISCHNURA
ISOTOMURUS
LIMNEPHILIDAE
LIMNODRILUS
LUMBRICULIDAE
MACRONYCHUS
MEROPELOPIA
MESOSMITTIA
MICROPSECTRA
MUSCULIUM
ORMOSIA
PARALAUTERBORNIELLA
PARAMERINA
PARAMETRIOCNEMUS
PARATANYTARSUS
PARATENDIPES
PHAENOPSECTRA
PHYLOCENTROPUS
PHYSELLA
POLYCENTROPUS
POLYPEDILUM
PROCLADIUS
PROMENETUS
PROSIMULIUM
PROSTOMA
PSEUDOLIMNOPHILA
PSEUDOSUCCINEA
PTILOSTOMIS
PYRALIDAE
RHEOTANYTARSUS
SIALIS
SMITTIA
SOMATOCHLORA
SPHAERIIDAE
SPIROSPERMA
STAGNICOLA
STEGOPTERNA
STENELMIS
STENOCHIRONOMUS
STYGONECTES
SYMPOSIOCLADIUS
SYNURELLA
TAENIOPTERYX
TANYTARSUS
THIENEMANNIELLA
TIPULA
TIPULIDAE
TRIAENODES
TRIBELOS
TUBIFICIDAE
TVETENIA
UNNIELLA
ZAVRELIMYIA

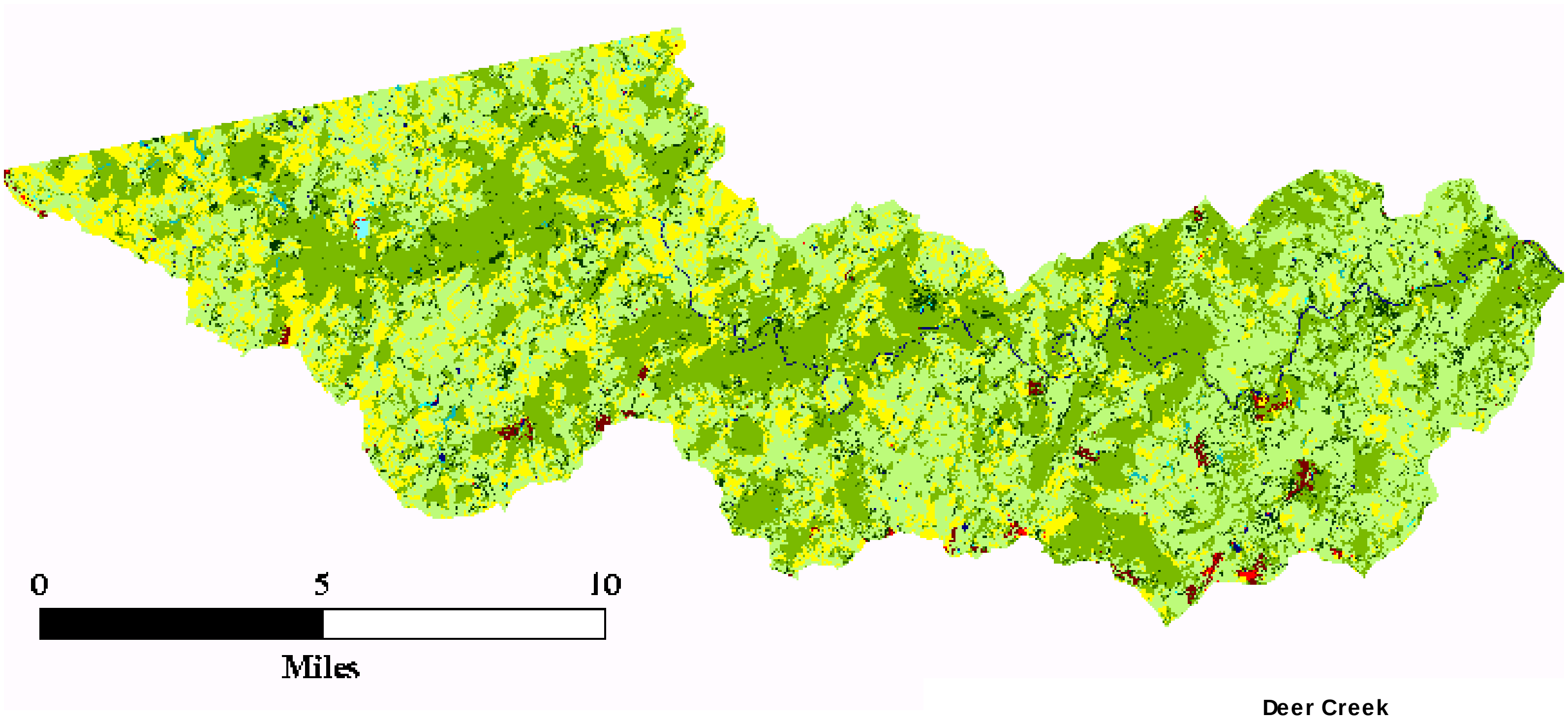
Herpetofauna Present

BULLFROG
COMMON MUSK TURTLE
EASTERN PAINTED TURTLE
GREEN FROG
NORTHERN TWO-LINED SALAMANDER

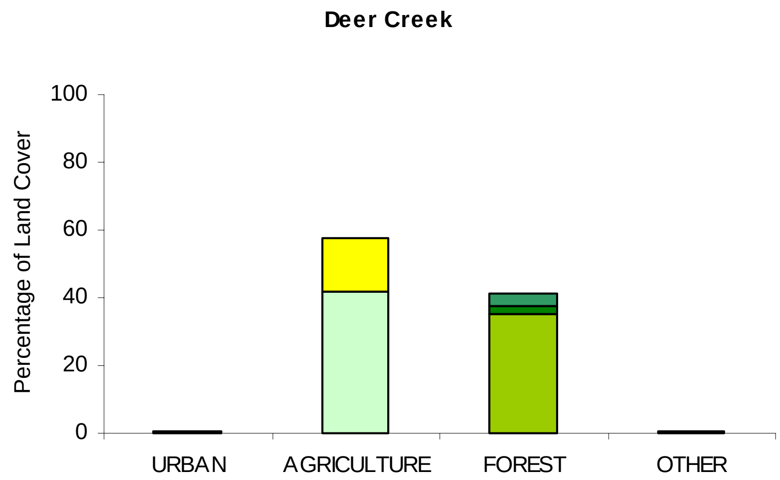


Deer Creek watershed
MBSS 2001
York County (PA)
Harford County
Baltimore County
Deer Creek
Norrisville
Nobles Mill
Rocks State Park
Susquehanna State Park
Little Deer Creek
Deer Creek
Big Branch
Island Branch
Thomas Run
Mill Brook
23
165
543
1
136
105
207
112
117
113
103
302
404
106
110
408
109
414
101
KM
0
2
4

Deer Creek



0
5
10
Miles



Deer Creek
Percentage of Land Cover
100
80
60
40
20
0
URBAN
AGRICULTURE
FOREST
OTHER

Deer Creek

Site Information

Site	Stream Name	12-Digit Subwatershed Code	8-digit Watershed	Basin	County	Date Sampled Spring	Date Sampled Summer	Order	Catchment Area (acres)
DEER-101-R-2001	DEER CR UT5	021202020321	Deer CR	SUSQUEHANNA RIVER	Harford	15-Mar-01	14-Jun-01	1	1213
DEER-103-R-2001	LITTLE DEER CR	021202020328	Deer CR	SUSQUEHANNA RIVER	Harford	08-Mar-01	27-Jun-01	1	120
DEER-105-R-2001	DEER CR UT2	021202020330	Deer CR	SUSQUEHANNA RIVER	Harford	08-Mar-01	25-Jun-01	1	384
DEER-106-R-2001	SOUTH STIRRUP RUN	021202020326	Deer CR	SUSQUEHANNA RIVER	Harford	15-Mar-01	26-Jun-01	1	406
DEER-109-R-2001	BUCK BR	021202020321	Deer CR	SUSQUEHANNA RIVER	Harford	15-Mar-01	26-Jun-01	1	389
DEER-110-R-2001	DEER CR UT4	021202020322	Deer CR	SUSQUEHANNA RIVER	Harford	14-Mar-01	26-Jun-01	1	131
DEER-112-R-2001	DEER CR UT1	021202020330	Deer CR	SUSQUEHANNA RIVER	Harford	08-Mar-01	27-Jun-01	1	545
DEER-113-R-2001	WET STONE BR	021202020327	Deer CR	SUSQUEHANNA RIVER	Harford	14-Mar-01	25-Jun-01	1	654
DEER-117-R-2001	LITTLE DEER CR UT1	021202020328	Deer CR	SUSQUEHANNA RIVER	Harford	14-Mar-01	25-Jun-01	1	52
DEER-207-R-2001	BIG BR	021202020331	Deer CR	SUSQUEHANNA RIVER	Harford	08-Mar-01	14-Jun-01	2	2622
DEER-302-R-2001	DEER CR	021202020324	Deer CR	SUSQUEHANNA RIVER	Harford	08-Mar-01	17-Jul-01	3	60277
DEER-404-R-2001	DEER CR	021202020324	Deer CR	SUSQUEHANNA RIVER	Harford	14-Mar-01	18-Jul-01	4	67587
DEER-408-R-2001	DEER CR	021202020322	Deer CR	SUSQUEHANNA RIVER	Harford	14-Mar-01	18-Jul-01	4	91680
DEER-414-R-2001	DEER CR	021202020321	Deer CR	SUSQUEHANNA RIVER	Harford	15-Mar-01	17-Jul-01	4	106080

Indicator Information

Site	FIBI	BIBI	PHI	Brook Trout Present	Black Water Stream
DEER-101-R-2001	3.89	4.78	78.99	0	0
DEER-103-R-2001	NR	4.11	10.77	0	0
DEER-105-R-2001	1.89	4.56	61.99	0	0
DEER-106-R-2001	3.89	2.78	31.34	1	0
DEER-109-R-2001	3.44	3.89	25.61	0	0
DEER-110-R-2001	NR	3.44	58.46	0	0
DEER-112-R-2001	3.22	4.33	62.37	0	0
DEER-113-R-2001	4.33	4.78	84.46	1	0
DEER-117-R-2001	NR	4.11	5.25	1	0
DEER-207-R-2001	3.44	4.56	73.84	0	0
DEER-302-R-2001	4.78	4.11	94.68	0	0
DEER-404-R-2001	3.67	4.11	65.21	0	0
DEER-408-R-2001	4.56	4.56	98.98	0	0
DEER-414-R-2001	4.11	4.33	93.17	0	0

Catchment Land Use Information

Site	Percent Urban	Percent Agriculture	Percent Forest	Percent Other	Percent Impervious Surface
DEER-101-R-2001	0.03	70.39	29.32	0.26	0.02
DEER-103-R-2001	3.39	81.77	14.84	0.00	0.84
DEER-105-R-2001	0.08	80.10	19.49	0.33	0.02
DEER-106-R-2001	0.31	55.05	44.57	0.08	0.08
DEER-109-R-2001	0.00	75.93	24.07	0.00	0.00
DEER-110-R-2001	0.00	68.67	31.33	0.00	0.00
DEER-112-R-2001	0.00	70.30	29.70	0.00	0.00
DEER-113-R-2001	0.19	39.57	60.24	0.00	0.07
DEER-117-R-2001	0.00	100.00	0.00	0.00	0.00
DEER-207-R-2001	0.12	76.85	22.76	0.28	0.05
DEER-302-R-2001	0.90	62.29	36.18	0.62	0.29
DEER-404-R-2001	0.82	60.91	37.61	0.66	0.26
DEER-408-R-2001	0.93	59.59	38.77	0.71	0.30
DEER-414-R-2001	0.93	59.80	38.52	0.75	0.30

Deer Creek

Water Chemistry Information

Site	Closed pH	Specific Cond.	ANC (µeq/L)	Cl (mg/L)	Nitrate-N (mg/L)	SO4 (mg/L)	T-P (mg/L)	Ortho-P (mg/L)	Nitrite (mg/L)	Ammonia (mg/L)	T-N (mg/L)	DOC (mg/L)	DO (mg/L)	Turbidity (mg/L)
DEER-101-R-2001	7.84	172.0	398.3	17.489	2.997	16.699	0.0178	0.008	0.0017	0.003	3.353	0.954	8.4	2.3
DEER-103-R-2001	7.28	258.0	485.0	28.783	7.771	12.269	0.0149	0.015	0.0075	0.002	8.441	1.160	8.2	1.7
DEER-105-R-2001	7.24	158.4	268.2	15.110	6.219	5.295	0.0529	0.031	0.0140	0.005	7.109	1.249	10.2	4.3
DEER-106-R-2001	7.15	103.7	285.8	8.824	1.616	8.934	0.0104	0.006	0.0024	0.007	1.777	0.738	8.2	1.9
DEER-109-R-2001	7.25	195.2	513.5	10.071	4.994	24.017	0.0250	0.015	0.0004	0.014	5.303	1.056	9.2	2.8
DEER-110-R-2001	7.49	129.2	448.7	14.325	1.984	4.903	0.0146	0.004	0.0029	0.016	2.115	1.212	8.8	9
DEER-112-R-2001	7.08	155.6	248.8	16.377	4.821	7.005	0.0728	0.007	0.0041	0.004	5.532	0.689	8.3	7.8
DEER-113-R-2001	7.07	76.2	171.8	7.219	2.137	3.491	0.0078	0.001	0.0013	0.002	2.324	1.052	9	3.7
DEER-117-R-2001	6.58	189.8	190.3	19.094	9.912	5.446	0.0178	0.006	0.0004	0.006	9.962	0.457	8.8	7.3
DEER-207-R-2001	7.25	134.4	198.6	13.125	5.650	4.016	0.0098	0.003	0.0047	0.008	6.109	0.842	8.8	2.7
DEER-302-R-2001	7.92	177.8	347.0	23.584	3.684	5.833	0.0155	0.015	0.0137	0.006	4.177	1.056	9.2	2.3
DEER-404-R-2001	7.38	165.5	387.6	20.739	3.278	6.682	0.0255	0.001	0.0085	0.005	3.803	2.457	9.1	2.1
DEER-408-R-2001	7.67	189.6	436.8	28.005	3.134	7.847	0.0234	0.001	0.0117	0.004	3.514	1.878	7.3	2.5
DEER-414-R-2001	7.74	183.7	467.4	24.860	2.929	9.016	0.0164	0.001	0.0079	0.003	3.326	1.558	7.6	2.6

Physical Habitat Condition

Site	Riparian Buffer Width Left	Riparian Buffer Width Right	Adjacent Cover Left	Adjacent Cover Right	Instream Habitat Structure	Epifaunal Substrate	Velocity/ Depth Diversity	Pool/ Glide/ Eddy Quality	Extent of Pools (m)	Riffle/ Run Quality	Extent of Riffles (m)	Embed-dedness	Shading	Trash Rating	Maximum Depth (cm)
DEER-101-R-2001	50	50	FR	FR	17	17	9	9	30	15	50	20	96	20	38
DEER-103-R-2001	10	8	CP	CP	7	7	7	7	47	11	30	40	80	8	37
DEER-105-R-2001	50	50	FR	FR	15	17	8	7	8	15	71	18	95	17	24
DEER-106-R-2001	0	0	FR	CP	10	10	8	9	33	10	42	45	75	15	35
DEER-109-R-2001	50	21	FR	PA	11	12	7	7	39	11	40	28	92	18	49
DEER-110-R-2001	50	50	FR	FR	15	17	7	7	6	13	71	20	89	5	30
DEER-112-R-2001	50	50	OF	OF	12	12	13	13	44	13	32	20	65	18	62
DEER-113-R-2001	50	50	FR	FR	15	17	13	11	34	15	48	30	95	8	51
DEER-117-R-2001	4	3	PA	PA	7	4	6	6	6	8	70	90	90	16	28
DEER-207-R-2001	20	23	PV	PV	16	16	15	15	29	16	48	30	80	16	97
DEER-302-R-2001	8	50	PV	FR	18	16	17	15	65	19	60	30	35	13	81
DEER-404-R-2001	50	50	FR	FR	12	11	15	13	75	16	15	60	70	18	64
DEER-408-R-2001	50	42	FR	CP	18	17	17	15	50	19	75	25	65	17	80
DEER-414-R-2001	50	50	OF	OF	17	15	18	15	70	19	70	35	65	17	120

Deer Creek

Physical Habitat Modifications

Site	Buffer Breaks ?	Surface Mine?	Landfill?	Channelization?	Erosion Severity Left	Erosion Severity Right	Bar Formation
DEER-101-R-2001	N	N	N	N	Mild	Mild	Moderate
DEER-103-R-2001	N	N	N	N	Moderate	Moderate	Minor
DEER-105-R-2001	N	N	N	N	Mild	Mild	Minor
DEER-106-R-2001	Y	N	N	N	Moderate	Moderate	Minor
DEER-109-R-2001	N	N	N	N	Mild	Moderate	Moderate
DEER-110-R-2001	N	N	N	N	Moderate	Mild	Minor
DEER-112-R-2001	N	N	N	N	Moderate	Moderate	Minor
DEER-113-R-2001	N	N	N	N	Mild	Mild	Minor
DEER-117-R-2001	Y	N	N	N	Mild	Mild	None
DEER-207-R-2001	Y	N	N	Y	Moderate	Mild	Minor
DEER-302-R-2001	N	N	N	N	None	Moderate	Minor
DEER-404-R-2001	N	N	N	N	Mild	Mild	None
DEER-408-R-2001	N	N	N	N	Mild	Moderate	Severe
DEER-414-R-2001	N	N	N	N	Moderate	Moderate	Severe

Interpretation of Watershed Condition

- Many big, deep streams with many fish species
- Agricultural land use is high in many catchments (100% at site 117)
- Nitrogen levels are elevated at all sites
- Physical habitat parameters are generally good

Deer Creek

Stream Waders Data

Site	8-Digit Watershed	12-Digit Subwatershed	Stream Name	Benthic IBI
0332-5	Deer Creek	021202020332	DEER CR	2.71
0332-4	Deer Creek	021202020332	PLUM TREE BR	4.43
0332-3	Deer Creek	021202020332	DEER CR	3.00
0321-3	Deer Creek	021202020321	DEER CR UT	4.43
0321-4	Deer Creek	021202020321	BUCKS BR	4.14
0324-4	Deer Creek	021202020324	DEER CR	3.86
0324-1	Deer Creek	021202020324	DEER CR	3.57
0327-3	Deer Creek	021202020327	GLADDEN BR	4.71
0327-93	Deer Creek	021202020327	GLADDEN BR	3.86
0327-94	Deer Creek	021202020327	DEER CR	3.00
0323-5	Deer Creek	021202020323	THOMAS RUN UT	3.86
0323-2	Deer Creek	021202020323	THOMAS RUN UT	3.86
0323-1	Deer Creek	021202020323	THOMAS RUN	3.86
0323-3	Deer Creek	021202020323	THOMAS RUN UT	3.57
0323-4	Deer Creek	021202020323	THOMAS RUN	3.57
0324-5	Deer Creek	021202020324	DEER CR	3.29
0322-1	Deer Creek	021202020322	TOBACCO RUN	2.43
0322-2	Deer Creek	021202020322	COOLBRANCH RUN	3.86
0322-5	Deer Creek	021202020322	MILL BROOK	2.43
0322-4	Deer Creek	021202020322	MILL BROOK UT	3.00
0322-3	Deer Creek	021202020322	MILL BROOK	3.86
0321-1	Deer Creek	021202020321	BUCKS BR	4.43
0327-4	Deer Creek	021202020327	DEER CR	3.57
0321-2	Deer Creek	021202020321	ELBOW BR	3.29
0321-5	Deer Creek	021202020321	DEER CR	4.43
0324-2	Deer Creek	021202020324	KELLOGG BR	3.86
0332-2	Deer Creek	021202020332	DEER CR UT	4.14
0332-1	Deer Creek	021202020332	DEER CR UT	2.43
0330-5	Deer Creek	021202020330	JACKSON BR	3.29
0327-91	Deer Creek	021202020327	DEER CR UT	3.29
0330-3	Deer Creek	021202020330	DEER CR UT	2.71
0327-1	Deer Creek	021202020327	DEER CR UT	2.71
0329-3	Deer Creek	021202020329	FALLING BR	3.00
0329-2	Deer Creek	021202020329	FALLING BR	3.86
0327-2	Deer Creek	021202020327	ROCK HOLLOW BR	5.00
0327-92	Deer Creek	021202020327	ROCK HOLLOW BR	3.00
0329-4	Deer Creek	021202020329	FALLING BR UT	4.14
0329-1	Deer Creek	021202020329	FALLING BR	3.86
0329-5	Deer Creek	021202020329	FALLING BR	4.43
0328-1	Deer Creek	021202020328	LITTLE DEER CR UT	2.14
0328-91	Deer Creek	021202020328	LITTLE DEER CR UT	4.14
0330-4	Deer Creek	021202020330	DEER CR UT	4.43
0330-2	Deer Creek	021202020330	ISLAND BR	2.14
0327-95	Deer Creek	021202020327	WET STONE BR	4.43
Site	**8-Digit Watershed**	**12-Digit Subwatershed**	**Stream Name**	**Benthic IBI**
0327-5	Deer Creek	021202020327	WET STONE BR	4.43
0328-2	Deer Creek	021202020328	CATTAIL BR	3.57

Deer Creek

Stream Waders Data

0328-92	Deer Creek	021202020328	CATTAIL BR	3.57
0328-3	Deer Creek	021202020328	LITTLE DEER CR CATTAIL BR	3.57
0328-5	Deer Creek	021202020328	LITTLE DEER CR	4.43
0328-95	Deer Creek	021202020328	LITTLE DEER CR	3.57
0331-1	Deer Creek	021202020331	BIG BR	4.71
0331-5	Deer Creek	021202020331	BIG BR	3.86
0331-2	Deer Creek	021202020331	BIG BR	4.43
0328-93	Deer Creek	021202020328	LITTLE DEER CR	1.86
0331-4	Deer Creek	021202020331	BIG BR	3.57
0328-94	Deer Creek	021202020328	LITTLE DEER CR UT	3.86
0328-4	Deer Creek	021202020328	LITTLE DEER CR UT	5.00
0331-3	Deer Creek	021202020331	BIG BR	4.43
0324-3	Deer Creek	021202020324	DEER CR UT	2.71
0330-1	Deer Creek	021202020330	DEER CR	3.57
0326-1	Deer Creek	021202020326	SOUTH STIRRUP RUN	1.86
0326-2	Deer Creek	021202020326	SOUTH STIRRUP RUN	3.29
0326-3	Deer Creek	021202020326	NORTH STIRRUP RUN	1.86
0326-4	Deer Creek	021202020326	NORTH STIRRUP RUN	3.29
0326-5	Deer Creek	021202020326	STIRRUP RUN	3.57
0325-1	Deer Creek	021202020325		2.71
0325-2	Deer Creek	021202020325	CABBAGE RUN	1.86
0325-3	Deer Creek	021202020325	STOUT BOTTLE BR	1.57
0325-4	Deer Creek	021202020325	STOUT BOTTLE BR	2.71
0325-5	Deer Creek	021202020324	STOUT BOTTLE BR	3.00

Deer Creek

Fish Species Present

AMERICAN EEL
BLACKNOSE DACE
BLUE RIDGE SCULPIN
BLUEGILL
BROOK TROUT
COMMON CARP
COMMON SHINER
CREEK CHUB
CUTLIPS MINNOW
CYPRINID HYBRID
EASTERN SILVERY MINNOW
FALLFISH
GREEN SUNFISH
LARGEMOUTH BASS
LOGPERCH
LONGNOSE DACE
MARGINED MADTOM
NORTHERN HOGSUCKER
PUMPKINSEED
RAINBOW TROUT
REDBREAST SUNFISH
RIVER CHUB
ROCK BASS
ROSYFACE SHINER
ROSYSIDE DACE
SATINFIN SHINER
SEA LAMPREY
SHIELD DARTER
SMALLMOUTH BASS
SPOTTAIL SHINER
SWALLOWTAIL SHINER
TESSELLATED DARTER
WHITE PERCH
WHITE SUCKER
YELLOW BULLHEAD
YELLOW PERCH

Exotic Plants Present

JAPANESE HONEYSUCKLE
MULTIFLORA ROSE
MILE-A-MINUTE
MICROSTEGIUM

Benthic Taxa Present

ACERPENNA
ACRONEURIA
AGABUS
AGARODES
ALLOCAPNIA
AMELETUS
AMPHINEMURA
ANCHYTARSUS
ANTOCHA
APSECTROTANYPUS
BAETIDAE
BAETIS
BEZZIA
BOYERIA
BRILLIA
BRUNDINIELLA
CALOPTERYX
CAPNIIDAE
CERATOPOGON
CERATOPOGONIDAE
CHEUMATOPSYCHE
CHIMARRA
CHLOROPERLIDAE
CLINOCERA
CONCHAPELOPIA
CORBICULA
CORYNONEURA
CRICOTOPUS/ORTHOCLADIUS
CURA
CYMBIODYTA
DIAMESA
DIAMESINAE
DICRANOTA
DIPLECTRONA
DIXA
DOLICHOPODIDAE
DOLOPHILODES
DRUNELLA
DUBIRAPHIA
ECTOPRIA
ENALLAGMA
ENOCHRUS
EPEORUS
EPHEMERELLA
EUKIEFFERIELLA
EURYLOPHELLA
FERRISSIA
GAMMARUS
GLOSSOSOMA
GOMPHIDAE
HABROPHLEBIA
HELICHUS
HELOCOMBUS
HELOPHORUS
HEMERODROMIA
HEPTAGENIIDAE
HEXATOMA
HYDATOPHYLAX
HYDROBAENUS
HYDROBIUS
HYDROPORUS
HYDROPSYCHE
HYDROPSYCHIDAE
HYDROPTILA
ISONYCHIA
ISOPERLA
ISOTOMURUS
LEPIDOSTOMA
LEPTOCERIDAE
LEPTOPHLEBIA
LEPTOPHLEBIIDAE
LEPTOXIS
LEUCTRA
LEUCTRIDAE
LIMNEPHILIDAE
LIMNODRILUS
LIMNOPHYES
LUMBRICULIDAE
LYMNAEIDAE
LYPE
MACRONYCHUS
MEROPELOPIA
MICRASEMA
MICROPSECTRA
MICROTENDIPES
MOLANNODES
NANOCLADIUS
NEMOURIDAE
NEOPHYLAX
NEURECLIPSIS
NIGRONIA
OPTIOSERVUS
ORTHOCLADIINAE
ORTHOCLADIINAE A
ORTHOCLADIUS
OULIMNIUS
PAGASTIA
PARAGNETINA
PARAKIEFFERIELLA
PARALEPTOPHLEBIA
PARAMETRIOCNEMUS
PARATANYTARSUS
PELTOPERLIDAE
PERLIDAE
PERLODIDAE
POLYCENTROPUS
POLYPEDILUM
POTTHASTIA
PROBEZZIA
PRODIAMESA
PROMORESIA
PROSIMULIUM
PROSTOIA
PSEPHENUS
PSEUDOLIMNOPHILA
PSEUDORTHOCLADIUS
PSYCHOMYIA
PYCNOPSYCHE
RHEOTANYTARSUS
RHYACOPHILA
SERRATELLA
SIALIS
SPHAERIIDAE
STAGNICOLA
STEGOPTERNA
STEMPELLINA
STEMPELLINELLA
STENELMIS
STENONEMA
STICTOCHIRONOMUS
STILOCLADIUS
STROPHOPTERYX
STYGONECTES
STYLOGOMPHUS
SYMPOTTHASTIA
SYNORTHOCLADIUS
TAENIOPTERYX
TALLAPERLA

Benthic Taxa Present (Con't)

TANYPODINAE
TANYTARSINI
TANYTARSUS
THIENEMANNIELLA
TIPULA
TRIAENODES

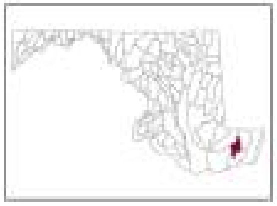
Deer Creek

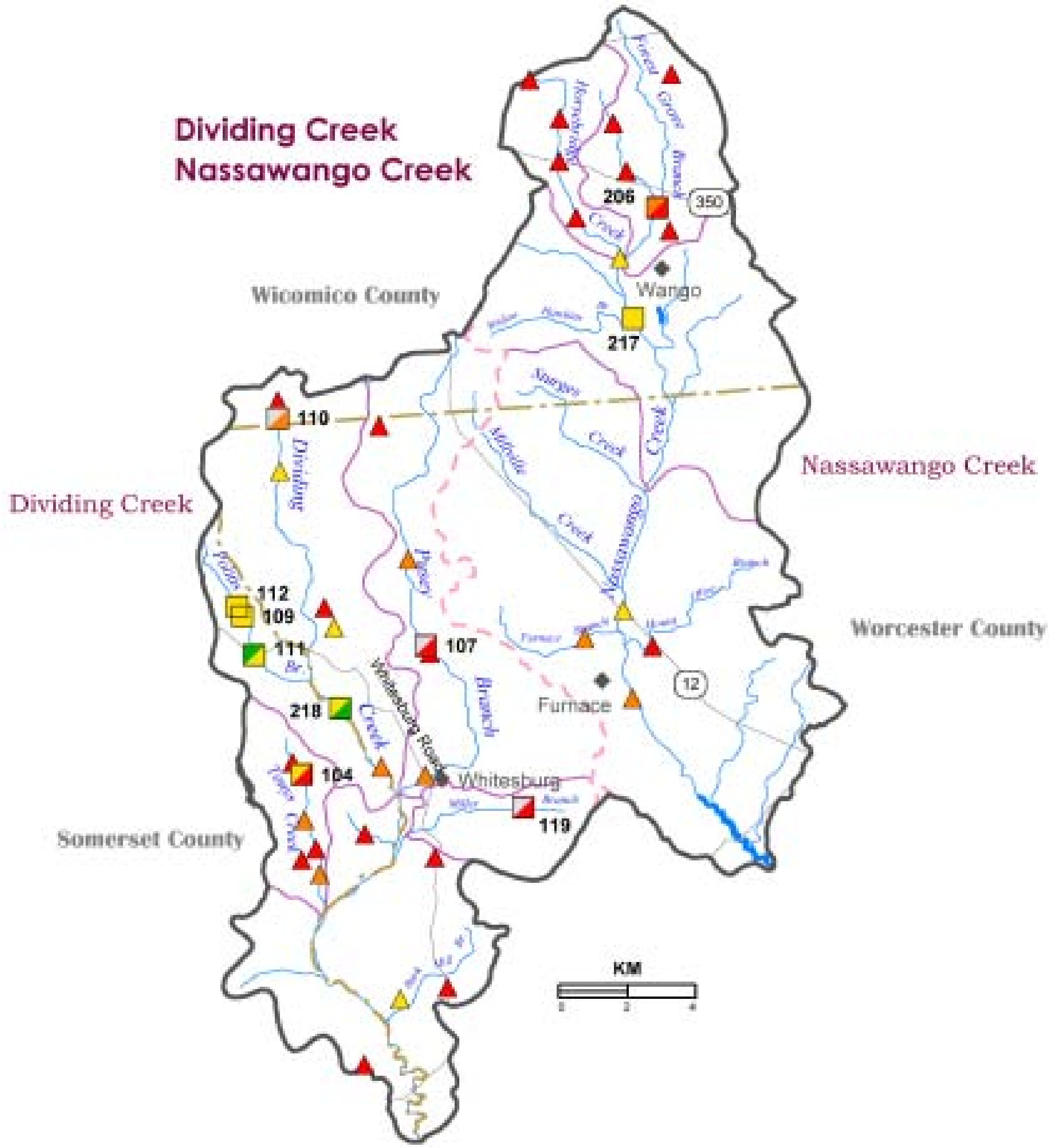
TRISSOPELOPIA
TUBIFICIDAE
TVETENIA
UNNIELLA
WORMALDIA
ZAVRELIMYIA

Herpetofauna Present

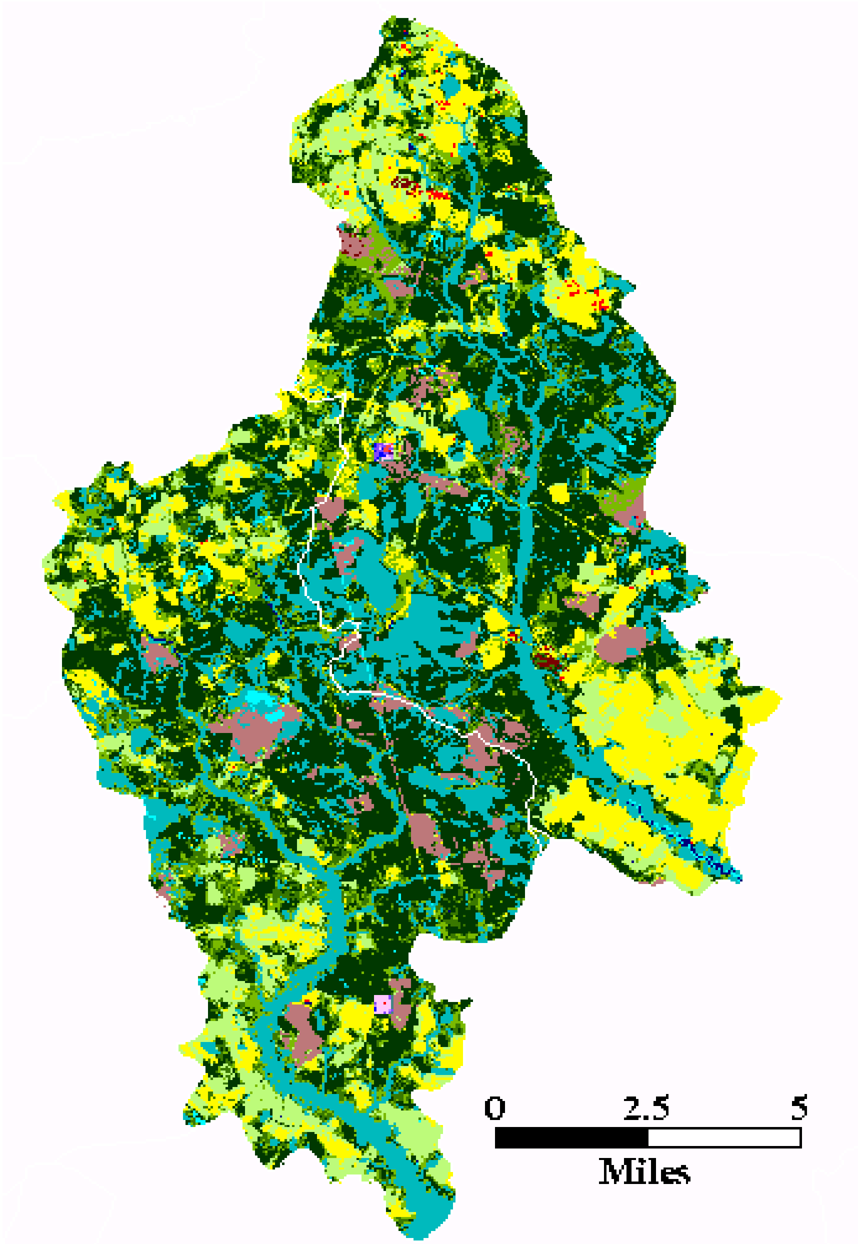
AMERICAN TOAD
BULLFROG
COMMON SNAPPING TURTLE
EASTERN BOX TURTLE
EASTERN GARTER SNAKE
FOWLER'S TOAD
GREEN FROG
LONGTAIL SALAMANDER
NORTHERN DUSKY SALAMANDER
NORTHERN TWO-LINED SALAMANDER
NORTHERN WATER SNAKE
PICKEREL FROG
REDBACK SALAMANDER

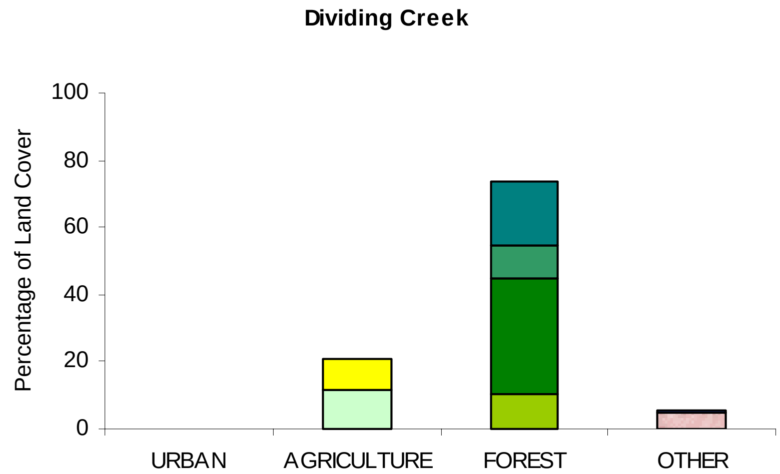
Dividing Creek\ Nassawango Creek watersheds MBSS 2001

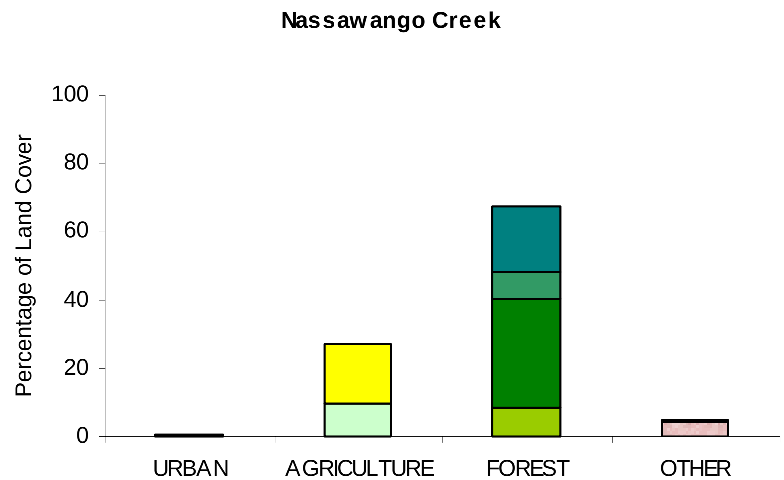




Dividing Creek/Nassawango Creek







Dividing Creek/Nassawango Creek

Site Information

Site	Stream Name	12-Digit Subwatershed Code	8-digit Watershed	Basin	County	Date Sampled Spring	Date Sampled Summer	Order	Catchment Area (acres)
DIVI-104-R-2001	TONY CR	021302040663	Dividing CR	POCOMOKE RIVER	Somerset	08-Mar-01	25-Jul-01	1	759
DIVI-107-R-2001	PUSEY BR	021302040666	Dividing CR	POCOMOKE RIVER	Worcester	08-Mar-01	25-Jul-01	1	5797
DIVI-109-R-2001	POLLITTS BR	021302040664	Dividing CR	POCOMOKE RIVER	Somerset	14-Mar-01	4-Jun-01	1	512
DIVI-110-R-2001	DIVIDING CR	021302040664	Dividing CR	POCOMOKE RIVER	Wicomico	06-Mar-01	18-Jun-01	1	287
DIVI-111-R-2001	POLLITTS BR	021302040664	Dividing CR	POCOMOKE RIVER	Somerset	14-Mar-01	4-Jun-01	1	1292
DIVI-112-R-2001	POLLITTS BR	021302040664	Dividing CR	POCOMOKE RIVER	Somerset	14-Mar-01	4-Jun-01	1	436
DIVI-119-R-2001	MILLER BR	021302040665	Dividing CR	POCOMOKE RIVER	Worcester	08-Mar-01	6-Jun-01	1	1237
DIVI-218-R-2001	DIVIDING CR	021302040664	Dividing CR	POCOMOKE RIVER	Wicomico	14-Mar-01	25-Jul-01	2	10890
NASS-206-R-2001	NASSAWANGO CR	021302050669	Nassawango CR	POCOMOKE RIVER	Wicomico	14-Mar-01	24-Jul-01	2	4169
NASS-217-R-2001	NASSAWANGO CR	021302050668	Nassawango CR	POCOMOKE RIVER	Wicomico	08-Mar-01	23-Aug-01	2	9779

Indicator Information

Site	FIBI	BIBI	PHI	Brook Trout Present	Black Water Stream
DIVI-104-R-2001	3.25	1.57	37.00	0	1
DIVI-107-R-2001	NS	1.29	NS	NS	NS
DIVI-109-R-2001	3.25	3.57	81.00	0	0
DIVI-110-R-2001	NR	2.14	23.87	0	1
DIVI-111-R-2001	4.75	3.57	81.51	0	0
DIVI-112-R-2001	3.75	3.29	75.60	0	0
DIVI-119-R-2001	NR	1.86	47.44	0	1
DIVI-218-R-2001	3.50	4.14	86.11	0	1
NASS-206-R-2001	2.50	1.29	45.80	0	0
NASS-217-R-2001	3.25	3.86	75.80	0	1

Catchment Land Use Information

Site	Percent Urban	Percent Agriculture	Percent Forest	Percent Other	Percent Impervious Surface
DIVI-104-R-2001	0.00	10.44	84.79	4.77	0.00
DIVI-107-R-2001	0.10	20.71	76.10	3.10	0.06
DIVI-109-R-2001	0.00	31.05	67.78	1.17	0.00
DIVI-110-R-2001	0.00	22.25	77.75	0.00	0.00
DIVI-111-R-2001	0.00	26.61	72.93	0.46	0.00
DIVI-112-R-2001	0.00	35.50	63.13	1.37	0.00
DIVI-119-R-2001	0.00	1.61	88.53	9.87	0.00
DIVI-218-R-2001	0.03	21.19	72.45	6.33	0.17
NASS-206-R-2001	2.27	34.89	62.22	0.61	1.23
NASS-217-R-2001	1.30	35.42	59.62	3.66	0.69

Interpretaton of Watershed Condition

- Most watersheds contain significant amounts of forested land
- Low ANC and DOC levels, as well as the absence of riffles may reflect natural, swampy conditions
- Channelization and ditching are significant at most sites

Dividing Creek/Nassawango Creek

Water Chemistry Information

Site	Closed pH	Specific Cond.	ANC (µeq/L)	Cl (mg/L)	Nitrate-N (mg/L)	SO4 (mg/L)	T-P (mg/L)	Ortho-P (mg/L)	Nitrite (mg/L)	Ammonia (mg/L)	T-N (mg/L)	DOC (mg/L)	DO (mg/L)	Turbidity (mg/L)
DIVI-104-R-2001	4.89	78.5	1.8	9.502	0.513	9.007	0.0140	0.004	0.0052	0.008	0.846	14.035	NS	23
DIVI-107-R-2001	5.21	87.2	13.4	11.421	0.710	8.736	0.0198	0.010	0.0017	0.016	1.081	11.912	NS	NS
DIVI-109-R-2001	6.00	55.3	76.9	5.651	0.275	7.782	0.0124	0.001	0.0004	0.020	0.354	5.591	6.4	2.7
DIVI-110-R-2001	5.84	95.3	68.1	13.520	0.305	10.228	0.2027	0.137	0.0028	0.007	0.941	16.090	6.5	8.1
DIVI-111-R-2001	5.34	82.8	23.3	6.358	1.452	12.711	0.0170	0.001	0.0004	0.053	1.898	5.831	8.1	3.8
DIVI-112-R-2001	6.08	56.0	95.6	5.163	0.255	7.423	0.0104	0.001	0.0010	0.004	0.308	5.942	7.8	2.7
DIVI-119-R-2001	4.17	84.8	-77.8	8.350	0.001	9.196	0.0058	0.001	0.0026	0.007	0.406	19.677	3.5	2.8
DIVI-218-R-2001	6.16	82.4	86.8	8.347	1.033	8.946	0.0423	0.001	0.0011	0.014	1.463	9.512	NS	17
NASS-206-R-2001	6.45	151.7	240.2	20.512	0.700	14.260	0.0491	0.010	0.0067	0.042	1.422	15.048	2.9	150
NASS-217-R-2001	6.63	128.5	169.1	15.908	1.246	12.018	0.0226	0.020	0.0032	0.011	1.757	9.984	4.8	8.3

Physical Habitat Condition

Site	Riparian Buffer Width Left	Riparian Buffer Width Right	Adjacent Cover Left	Adjacent Cover Right	Instream Habitat Structure	Epifaunal Substrate	Velocity/ Depth Diversity	Pool/ Glide/ Eddy Quality	Extent of Pools (m)	Riffle/ Run Quality	Extent of Riffles (m)	Embed-dedness	Shading	Trash Rating	Maximum Depth (cm)
DIVI-104-R-2001	50	50	FR	FR	15	0	5	8	75	0	0	100	95	19	37
DIVI-107-R-2001	50	50	FR	FR	NS	NS	NS	NS	NS	NS	NS	NS	NS	20	NS
DIVI-109-R-2001	50	50	FR	FR	18	12	7	16	75	0	0	100	10	18	92
DIVI-110-R-2001	50	50	FR	FR	13	10	3	7	75	6	5	100	45	20	25
DIVI-111-R-2001	50	45	TG	CP	18	13	12	15	75	0	0	100	20	16	65
DIVI-112-R-2001	50	50	FR	FR	16	11	9	15	75	0	0	100	15	16	83
DIVI-119-R-2001	50	50	FR	FR	16	5	5	10	75	0	0	100	92	20	41
DIVI-218-R-2001	50	50	FR	FR	17	13	10	18	75	0	0	100	89	18	86
NASS-206-R-2001	50	50	FR	FR	10	5	6	16	26	0	0	100	65	12	65
NASS-217-R-2001	50	50	FR	FR	16	16	12	13	65	15	38	100	85	16	74

Physical Habitat Modifications

Site	Buffer Breaks?	Surface Mine?	Landfill?	Channelization?	Erosion Severity Left	Erosion Severity Right	Bar Formation
DIVI-104-R-2001	N	N	N	N	None	Mild	Moderate
DIVI-107-R-2001	N	N	N	N	NS	NS	NS
DIVI-109-R-2001	Y	N	N	Y	None	None	None
DIVI-110-R-2001	Y	N	N	Y	None	None	Minor
DIVI-111-R-2001	N	N	N	Y	None	None	None
DIVI-112-R-2001	Y	N	N	Y	None	Mild	Minor
DIVI-119-R-2001	N	N	N	Y	Mild	Mild	None
DIVI-218-R-2001	N	N	N	N	None	None	Moderate
NASS-206-R-2001	N	N	N	Y	None	None	None
NASS-217-R-2001	N	N	N	N	None	None	Minor

Dividing Creek/Nassawango Creek

Stream Waders Data

Site	8-Digit Watershed	12-Digit Subwatershed	Stream Name	Benthic IBI
0664-2	Dividing Creek	021302040664	DENNEY BR	1.29
0663-5	Dividing Creek	021302040663	TONY'S CR	2.14
0664-1	Dividing Creek	021302040664		3.57
0666-3	Dividing Creek	021302040666	PUSEY BR	1.57
0666-1	Dividing Creek	021302040666	PUSEY BR	2.43
0666-4	Dividing Creek	021302040666	PUSEY BR	2.14
0664-5	Dividing Creek	021302040664	DIVIDING CR	2.14
0664-4	Dividing Creek	021302040664		1.86
0666-5	Dividing Creek	021302040666	PUSEY BR UT	1.86
0663-1	Dividing Creek	021302040663	TONY'S CR	1.57
0663-4	Dividing Creek	021302040663	TONY'S CR	1.00
0663-2	Dividing Creek	021302040663	TONY'S CR	2.14
0663-3	Dividing Creek	021302040663	TONY'S CR	1.86
0664-3	Dividing Creek	021302040664	DIVIDING CR	3.29
0662-1	Dividing Creek	021302040662	BURK MILL BRANCH	3.29
0662-2	Dividing Creek	021302040662		1.86
0662-3	Dividing Creek	021302040662	DIVIDING CREEK UT	1.57
0662-4	Dividing Creek	021302040662	BURK MILL BRANCH UT	1.57
0662-5	Dividing Creek	021302040662	DIVIDING CREEK UT	1.86
0669-4	Nassawango Creek	021302050669		1.57
0669-3	Nassawango Creek	021302050669	WANGO BR	1.29
0667-2	Nassawango Creek	021302050667		1.86
0667-3	Nassawango Creek	021302050667		2.71
0669-2	Nassawango Creek	021302050669	WASTE GATE CR	1.57
0667-4	Nassawango Creek	021302050667		3.00
0670-1	Nassawango Creek	021302050670	HORSEBRIDGE CR	3.29
0669-1	Nassawango Creek	021302050669	WASTE GATE CR	1.57
0667-1	Nassawango Creek	021302050667	FURNACE BR	2.14
0670-2	Nassawango Creek	021302050670	HORSEBRIDGE CR	1.57
0670-4	Nassawango Creek	021302050670	HORSEBRIDGE CR	1.29
0670-3	Nassawango Creek	021302050670	HORSEBRIDGE CR	1.57
0670-5	Nassawango Creek	021302050670	HORSEBRIDGE CR	1.29

Dividing Creek/Nassawango Creek

Fish Species Present
AMERICAN EEL
BANDED SUNFISH
BLUESPOTTED SUNFISH
BROWN BULLHEAD
CHAIN PICKEREL
CREEK CHUBSUCKER
EASTERN MUDMINNOW
GOLDEN SHINER
MUD SUNFISH
PIRATE PERCH
PUMPKINSEED
REDFIN PICKEREL
SWAMP DARTER
TADPOLE MADTOM
TESSELLATED DARTER
YELLOW BULLHEAD

Exotic Plants Present
JAPANESE HONEYSUCKLE
MULTIFLORA ROSE
MILE-A-MINUTE
MICROSTEGIUM

Benthic Taxa Present
ABLABESMYIA
ANCYRONYX
APSECTROTANYPUS
ARGIA
BEZZIA
BITTACOMORPHA
BOYERIA
CAECIDOTEA
CAENIS
CALOPTERYX
CERATOPOGON
CHAETOCLADIUS
CHAULIODES
CHEUMATOPSYCHE
CHRYSOPS
CLADOTANYTARSUS
CLINOTANYPUS
CNEPHIA
COENAGRIONIDAE
CONCHAPELOPIA
CORIXIDAE
CORYNONEURA
CRANGONYX
CRICOTOPUS/ORTHOCLADIUS
CRYPTOTENDIPES
DICROTENDIPES
DIPLOCLADIUS
DIPTERA
DUBIRAPHIA
DUGESIA
ENALLAGMA
EURYLOPHELLA
GORDIIDAE
GRENIERA
HEMERODROMIA
HETEROTRISSOCLADIUS
HEXATOMA
HYALELLA
HYDROBAENUS
HYDROPORUS
IRONOQUIA
ISOTOMURUS
LABRUNDINIA
LARSIA
LEPTOPHLEBIA
LIMNEPHILIDAE
LIMNOPHILUS
LIMNOPHYES
LUMBRICULIDAE
LYPE
MEROPELOPIA
MESOSMITTIA
MICROTENDIPES
MOLANNA
MOLANNODES
NANOCLADIUS
NEMOURIDAE
OECETIS
ORMOSIA
ORTHOCLADIINAE
ORTHOCLADIUS
OXYETHIRA
PARAMETRIOCNEMUS
PARATANYTARSUS
PHAENOPSECTRA
PHYSELLA
PLACOBDELLA
PLATYCENTROPUS
POLYCENTROPUS
POLYPEDILUM
PROCAMBARUS
PSEUDOLIMNOPHILA
PYCNOPSYCHE
RHEOTANYTARSUS
SCIOMYZIDAE
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SIALIS
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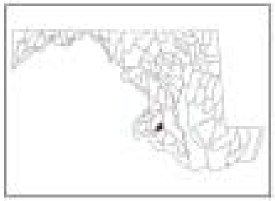
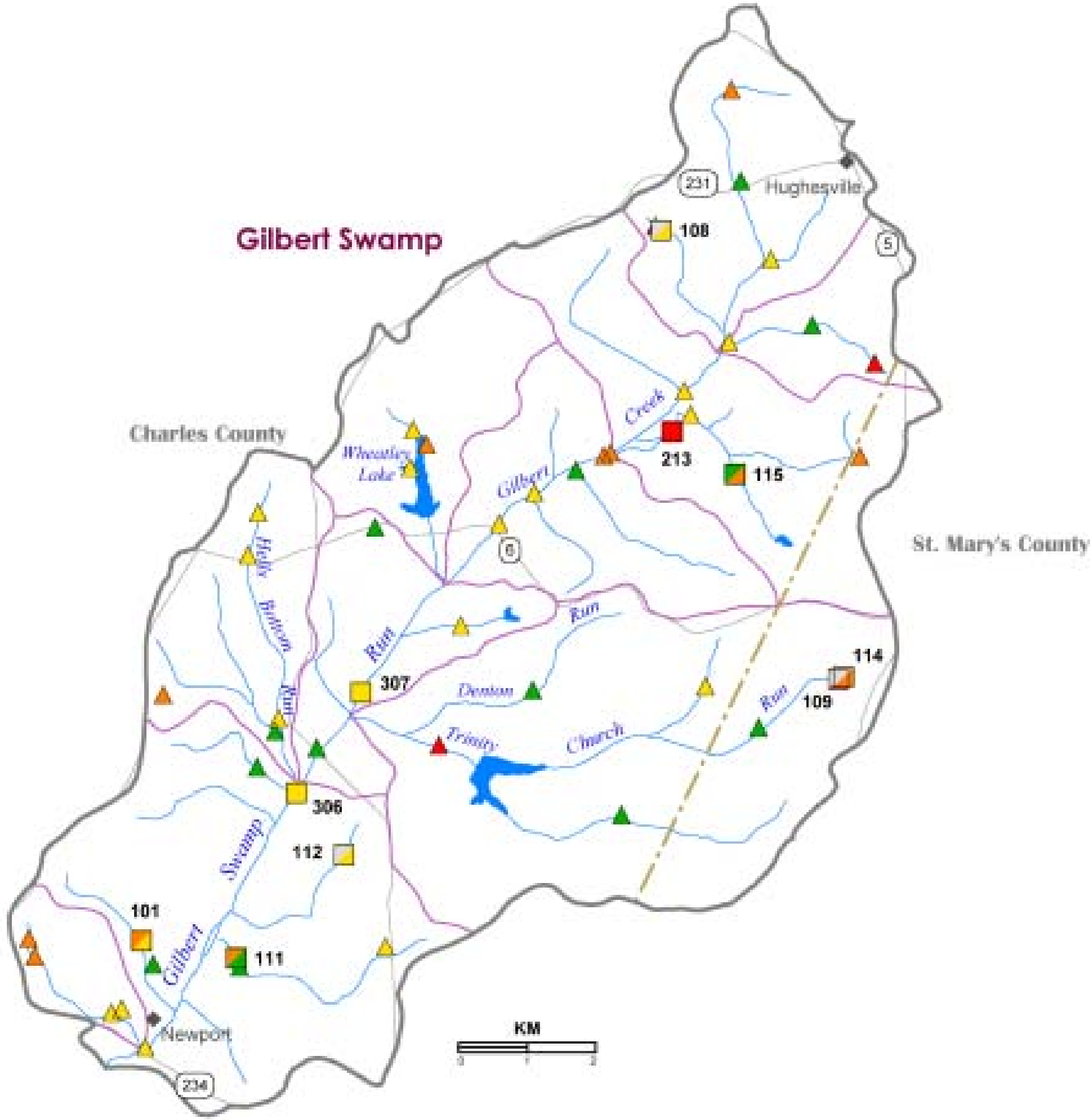
THIENEMANNIELLA
TRIAENODES
TRIBELOS
TUBIFICIDAE
TVETENIA
UNNIELLA
ZALUTSCHIA
ZAVRELIMYIA

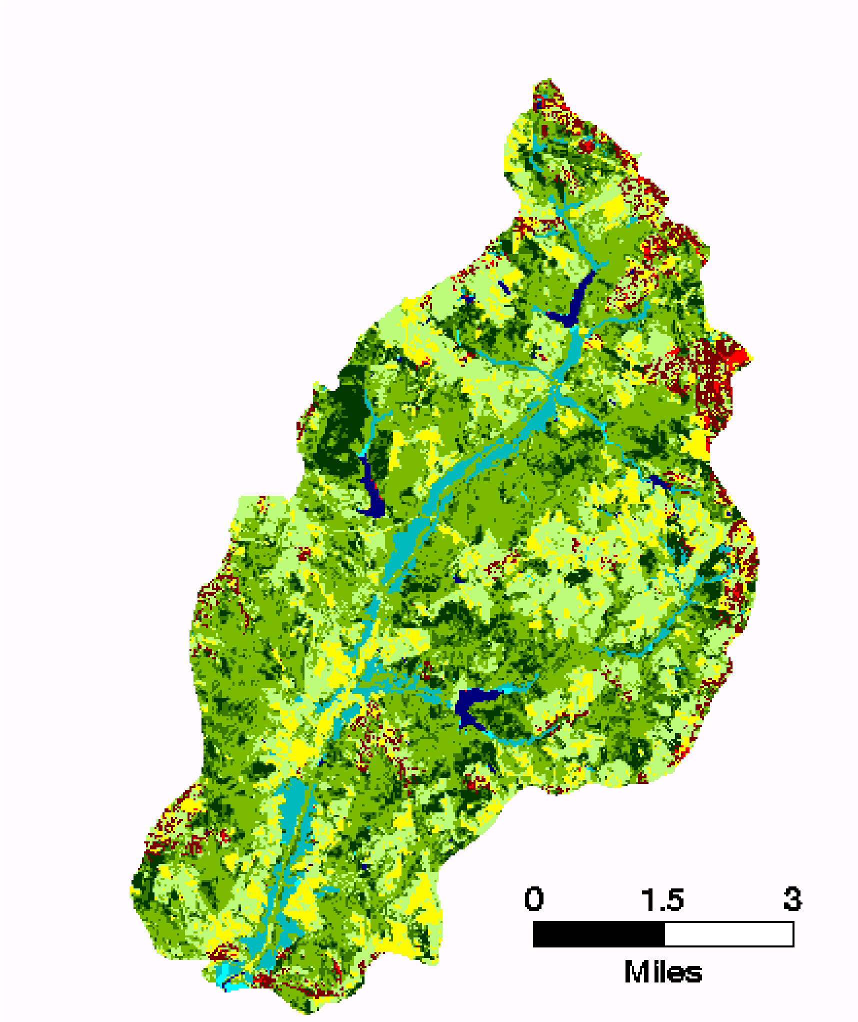
Herpetofauna Present
BULLFROG
COMMON SNAPPING TURTLE
EASTERN PAINTED TURTLE
FOWLER'S TOAD
GREEN FROG
PICKEREL FROG
SOUTHERN LEOPARD FROG
WOOD FROG

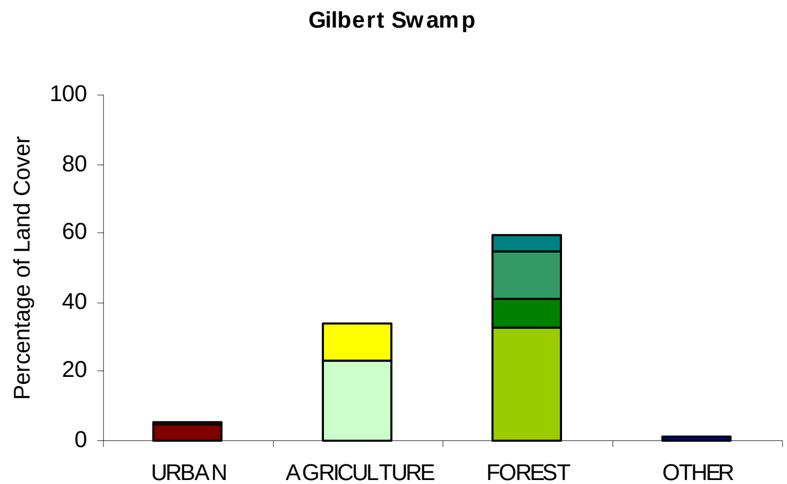


Gilbert Swamp watershed
MBSS 2001



Gilbert Swamp





Gilbert Swamp

Site Information

Site	Stream Name	12-Digit Subwatershed Code	8-digit Watershed	Basin	County	Date Sampled Spring	Date Sampled Summer	Order	Catchment Area (acres)
GILB-101-R-2001	LANCASTER RUN	021401070745	Gilbert Swamp	LOWER POTOMAC RIVER	Charles	01-Mar-01	12-Jun-01	1	506
GILB-108-R-2001	GILBERT CR UT1	021401070753	Gilbert Swamp	LOWER POTOMAC RIVER	Charles	07-Mar-01	19-Jun-01	1	30
GILB-109-R-2001	CHURCH RUN	021401070746	Gilbert Swamp	LOWER POTOMAC RIVER	St. Mary's	07-Mar-01	19-Jun-01	1	229
GILB-111-R-2001	ODEN RUN	021401070745	Gilbert Swamp	LOWER POTOMAC RIVER	Charles	01-Mar-01	12-Jun-01	1	1294
GILB-112-R-2001	FORD RUN	021401070745	Gilbert Swamp	LOWER POTOMAC RIVER	Charles	01-Mar-01	12-Jun-01	1	139
GILB-114-R-2001	CHURCH RUN	021401070746	Gilbert Swamp	LOWER POTOMAC RIVER	St. Mary's	07-Mar-01	19-Jun-01	1	214
GILB-115-R-2001	SMOOTS POND RUN	021401070751	Gilbert Swamp	LOWER POTOMAC RIVER	Charles	02-Mar-01	6-Aug-01	1	823
GILB-213-R-2001	GILBERT CR	021401070751	Gilbert Swamp	LOWER POTOMAC RIVER	Charles	02-Mar-01	6-Aug-01	2	1889
GILB-306-R-2001	GILBERT SWAMP RUN	021401070745	Gilbert Swamp	LOWER POTOMAC RIVER	Charles	07-Mar-01	4-Jun-01	3	21249
GILB-307-R-2001	GILBERT SWAMP RUN	021401070747	Gilbert Swamp	LOWER POTOMAC RIVER	Charles	02-Mar-01	4-Jun-01	3	11863

Indicator Information

Site	FIBI	BIBI	PHI	Brook Trout Present	Black Water Stream
GILB-101-R-2001	2.75	3.57	89.92	0	0
GILB-108-R-2001	NR	3.00	88.09	0	0
GILB-109-R-2001	NR	1.86	57.83	0	0
GILB-111-R-2001	2.75	4.71	77.19	0	0
GILB-112-R-2001	NR	3.00	46.07	0	0
GILB-114-R-2001	NR	2.43	51.02	0	0
GILB-115-R-2001	5.00	2.71	70.17	0	0
GILB-213-R-2001	1.00	1.86	6.29	0	0
GILB-306-R-2001	3.00	3.86	53.76	0	0
GILB-307-R-2001	3.50	3.86	75.40	0	0

Catchment Land Use Information

Site	Percent Urban	Percent Agriculture	Percent Forest	Percent Other	Percent Impervious Surface
GILB-101-R-2001	16.05	28.75	55.01	0.19	4.51
GILB-108-R-2001	8.42	41.05	50.53	0.00	2.63
GILB-109-R-2001	23.52	44.70	31.77	0.00	7.87
GILB-111-R-2001	0.68	46.92	52.20	0.19	0.23
GILB-112-R-2001	11.87	13.47	74.66	0.00	2.97
GILB-114-R-2001	22.30	45.64	32.05	0.00	6.91
GILB-115-R-2001	3.67	39.82	54.49	2.03	1.13
GILB-213-R-2001	8.50	31.33	58.91	1.27	2.60
GILB-306-R-2001	4.75	32.98	60.85	1.42	1.43
GILB-307-R-2001	5.37	30.38	62.58	1.67	1.67

Interpretation of Watershed Condition

- ANC values very low at all sites
- Phosphorus levels elevated at almost every site
- Logging activity at site 101
- Cows have access to the stream at sites 109 and 114
- Channelization is a problem at a few sites

Gilbert Swamp

Water Chemistry Information

Site	Closed pH	Specific Cond.	ANC (µeq/L)	Cl (mg/L)	Nitrate-N (mg/L)	SO4 (mg/L)	T-P (mg/L)	Ortho-P (mg/L)	Nitrite (mg/L)	Ammonia (mg/L)	T-N (mg/L)	DOC (mg/L)	DO (mg/L)	Turbidity (mg/L)
GILB-101-R-2001	6.64	89.1	171.2	7.329	1.084	11.141	0.0512	0.009	0.0038	0.022	1.388	1.881	7.6	3.6
GILB-108-R-2001	5.81	112.4	46.0	10.996	2.487	14.263	0.0123	0.001	0.0022	0.058	2.901	3.617	7.9	8.1

GILB-109-R-2001	6.03	103.4	90.7	10.449	0.971	15.479	0.0311	0.018	0.0020	0.060	1.235	4.067	7.7	5.2
GILB-111-R-2001	6.91	116.1	170.6	9.646	1.575	17.181	0.0188	0.015	0.0029	0.012	1.976	1.740	8.9	4.9
GILB-112-R-2001	6.36	90.9	64.4	12.923	0.133	12.648	0.0207	0.013	0.0005	0.020	0.242	1.932	6.9	2.5
GILB-114-R-2001	6.16	103.3	84.8	12.815	0.944	12.688	0.0284	0.009	0.0018	0.060	1.330	4.475	7.7	5.2
GILB-115-R-2001	6.55	94.3	127.8	8.178	1.517	11.832	0.0208	0.001	0.0099	0.031	1.930	3.223	6.4	4.8
GILB-213-R-2001	6.02	60.2	173.0	3.394	0.001	8.930	0.0463	0.007	0.0010	0.030	0.125	3.651	4.1	50.8
GILB-306-R-2001	6.92	108.1	192.6	12.336	0.732	12.806	0.0327	0.014	0.0044	0.007	0.959	3.512	9.4	7.8
GILB-307-R-2001	6.74	111.4	201.1	13.027	0.739	12.497	0.0232	0.003	0.0046	0.016	0.985	3.007	9.4	5.5

Physical Habitat Condition

Site	Riparian Buffer Width Left	Riparian Buffer Width Right	Adjacent Cover Left	Adjacent Cover Right	Instream Habitat Structure	Epifaunal Substrate	Velocity/ Depth Diversity	Pool/ Glide/ Eddy Quality	Extent of Pools (m)	Riffle/Run Quality	Extent of Riffles (m)	Embedded-ness	Shading	Trash Rating	Maximum Depth (cm)
GILB-101-R-2001	50	50	FR	FR	15	15	13	15	35	9	45	10	70	15	64
GILB-108-R-2001	50	50	FR	FR	18	18	12	13	41	10	28	20	95	16	52
GILB-109-R-2001	50	50	PA	PA	15	16	8	8	60	10	20	30	99	15	34
GILB-111-R-2001	5	5	CP	CP	14	12	13	13	35	11	50	60	90	13	66
GILB-112-R-2001	50	50	FR	FR	9	16	7	6	50	7	18	12	97	19	43
GILB-114-R-2001	50	50	PA	PA	13	17	8	7	42	11	36	20	98	15	29
GILB-115-R-2001	50	50	FR	FR	14	12	13	12	33	14	50	98	65	19	51
GILB-213-R-2001	50	50	FR	FR	4	6	2	5	75	0	0	98	95	18	13
GILB-306-R-2001	10	50	CP	FR	8	10	11	11	10	18	75	35	85	11	54
GILB-307-R-2001	50	10	FR	CP	13	17	11	11	10	17	75	25	82	17	52

Physical Habitat Modifications

Site	Buffer Breaks?	Surface Mine?	Landfill?	Channelization?	Erosion Severity Left	Erosion Severity Right	Bar Formation
GILB-101-R-2001	N	N	N	N	Moderate	Mild	Severe
GILB-108-R-2001	N	N	N	N	Mild	Mild	Moderate
GILB-109-R-2001	Y	N	N	N	Mild	Mild	Minor
GILB-111-R-2001	Y	N	N	Y	Moderate	Moderate	Minor
GILB-112-R-2001	N	N	N	N	Severe	Moderate	Severe
GILB-114-R-2001	Y	N	N	N	Moderate	Moderate	Moderate
GILB-115-R-2001	N	N	N	N	None	None	Minor
GILB-213-R-2001	N	N	N	N	None	None	Minor
GILB-306-R-2001	N	N	N	Y	None	None	None
GILB-307-R-2001	N	N	N	Y	None	None	None

Gilbert Swamp

Stream Waders Data

Site	8-Digit Watershed	12-Digit Subwatershed	Stream Name	Benthic IBI
0752-2	Gilbert Swamp	021401070752	GILBERT CR UT	4.71
0751-1	Gilbert Swamp	021401070751	GILBERT CR UT	3.86
0753-3	Gilbert Swamp	021401070753	GILBERT CR	3.86
0753-2	Gilbert Swamp	021401070753	GILBERT SWAMP RUN UT	4.71
0751-4	Gilbert Swamp	021401070751	OAKS RUN	2.43
0753-4	Gilbert Swamp	021401070753	GILBERT CR UT	1.57
0749-4	Gilbert Swamp	021401070749	GILBERT SWAMP RUN	4.14
0746-5	Gilbert Swamp	021401070746	TRINITY CHURCH RUN UT	3.57
0746-3	Gilbert Swamp	021401070746	TRINITY CHURCH RUN UT	4.71
0746-4	Gilbert Swamp	021401070746	TRINITY CHURCH RUN	4.14
0751-2	Gilbert Swamp	021401070751	GILBERT CR UT	2.71
0751-3	Gilbert Swamp	021401070751	SMOOTS POND RUN	3.29
0752-1	Gilbert Swamp	021401070752	GILBERT CR UT	3.86
0746-2	Gilbert Swamp	021401070746	TRINITY CHURCH RUN	1.29
0744-2	Gilbert Swamp	021401070744	MURPHY RUN	2.43
0747-2	Gilbert Swamp	021401070747	GILBERT SWAMP RUN UT	3.86
0749-3	Gilbert Swamp	021401070749	GILBERT CR	2.43
0748-2	Gilbert Swamp	021401070748	HELLS BOTTOM RUN	3.29
0752-3	Gilbert Swamp	021401070752	GILBERT CR UT	1.86
0745-2	Gilbert Swamp	021401070745	ODEN RUN	4.43
0748-3	Gilbert Swamp	021401070748	HELLS BOTTOM RUN	3.86
0748-5	Gilbert Swamp	021401070748	ST. STEPHEN RN	4.71
0744-1	Gilbert Swamp	021401070744	MURPHY RUN	2.43
0745-5	Gilbert Swamp	021401070745	IVORY RUN	4.43
0745-4	Gilbert Swamp	021401070745	LANCASTER RUN	4.43
0749-2	Gilbert Swamp	021401070749	GILBERT CR	3.00
0746-1	Gilbert Swamp	021401070746	DENTON RUN	4.14
0745-3	Gilbert Swamp	021401070745	ODEN RUN	3.29
0750-4	Gilbert Swamp	021401070750		3.86
0750-1	Gilbert Swamp	021401070750		3.57
0744-3	Gilbert Swamp	021401070744	MURPHY RUN	3.00
0744-4	Gilbert Swamp	021401070744	PEACH RUN	3.29
0749-1	Gilbert Swamp	021401070749	GILBERT CR RUN	3.57
0747-1	Gilbert Swamp	021401070747	GILBERT SWAMP RUN UT	4.43
0750-2	Gilbert Swamp	021401070750		2.43
0745-1	Gilbert Swamp	021401070745	GILBERT RUN	3.29
0747-3	Gilbert Swamp	021401070747	GILBERT SWAMP RUN	4.43
0748-1	Gilbert Swamp	021401070748		2.43
0748-4	Gilbert Swamp	021401070748	HELLS BOTTOM RUN	3.29
0753-1	Gilbert Swamp	021401070753	GILBERT SWAMP RUN UT	2.71

Gilbert Swamp

Fish Species Present

AMERICAN EEL
BLACKNOSE DACE
BLUEGILL
CREEK CHUBSUCKER
EASTERN MUDMINNOW
FALLFISH
GOLDEN SHINER
LARGEMOUTH BASS
LEAST BROOK LAMPREY
MARGINED MADTOM
PUMPKINSEED
REDBREAST SUNFISH
REDFIN PICKEREL
ROSYSIDE DACE
SATINFIN SHINER
SEA LAMPREY
SPOTTAIL SHINER
SWALLOWTAIL SHINER
TADPOLE MADTOM
TESSELLATED DARTER

Exotic Plants Present

JAPANESE HONEYSUCKLE
MULTIFLORA ROSE
MILE-A-MINUTE
MICROSTEGIUM

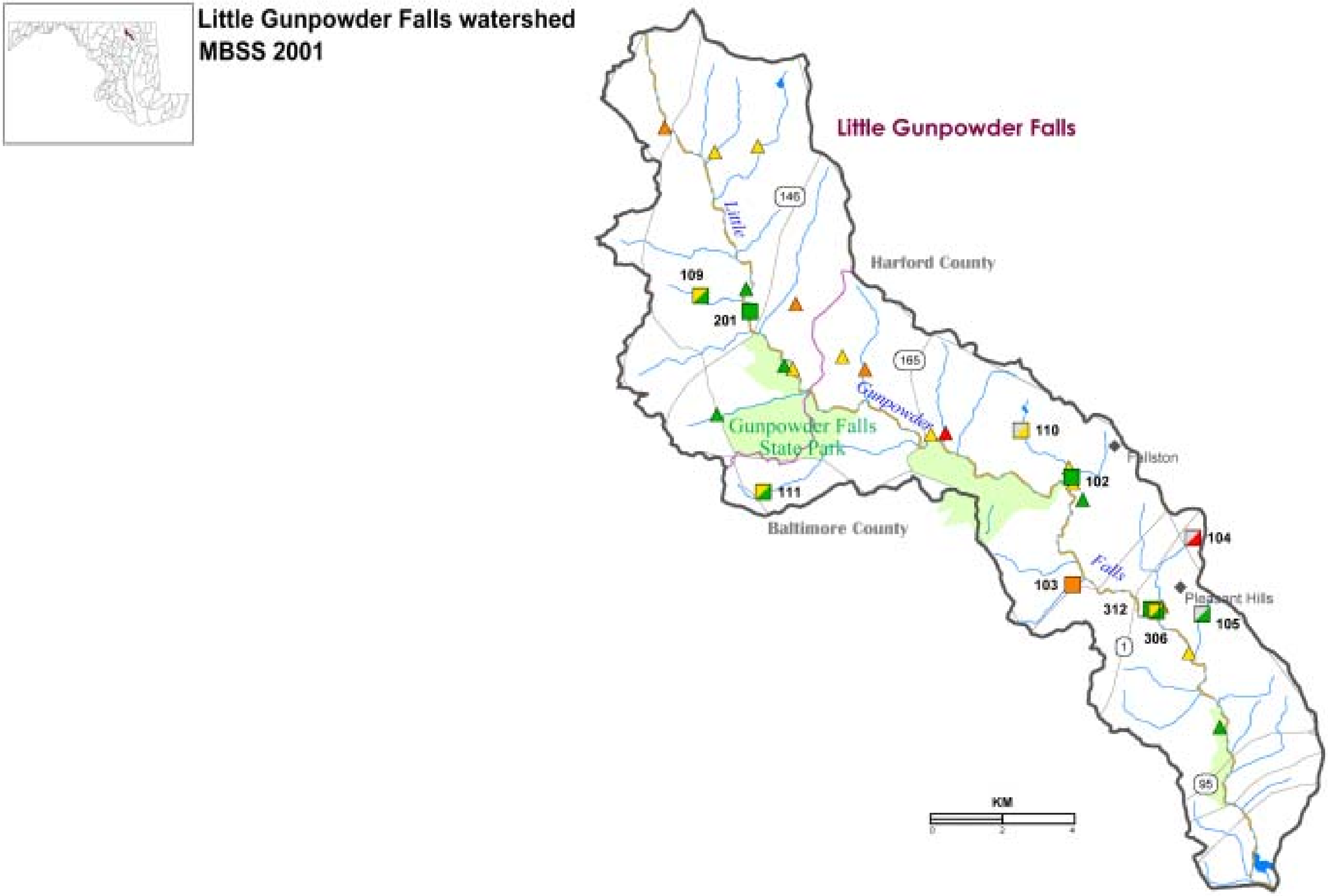
Benthic Taxa Present

ABLABESMYIA
ACERPENNA
ALLOCAPNIA
AMELETUS
AMPHINEMURA
ANTOCHA
APSECTROTANYPUS
BEZZIA
BITTACOMORPHA
BRILLIA
CAECIDOTEA
CERATOPOGON
CERATOPOGONIDAE
CHEUMATOPSYCHE
CHLOROPERLIDAE
CHRYSOPS
CLINOTANYPUS
CONCHAPELOPIA
CORDULEGASTER
CORYNONEURA
CRANGONYCTIDAE
CRANGONYX
CRICOTOPUS/ORTHOCLADIUS
CRYPTOCHIRONOMUS
CULICOIDES
DICRANOTA
DIPLECTRONA
DIPTERA
DOLOPHILODES
ECCOPTURA
ENDOCHIRONOMUS
EPHEMERELLA
EUKIEFFERIELLA
EURYLOPHELLA
GORDIIDAE
HEMERODROMIA
HETEROTRISSOCLADIUS
HEXATOMA
HIRUDINEA
HYDROPORUS
HYDROPSYCHE
HYDROPSYCHIDAE
ISOPERLA
ISOTOMURUS
LEPTOPHLEBIA
LEPTOPHLEBIIDAE
LEUCTRIDAE
LIMNEPHILIDAE
LOPESCLADIUS
LUMBRICULIDAE
MENETUS
MEROPELOPIA
MICROPSECTRA
MICROTENDIPES
NEMOURIDAE
NEOPHYLAX
NIGRONIA
OPTIOSERVUS
ORTHOCLADIINAE
OULIMNIUS
PARAMETRIOCNEMUS
PARATANYTARSUS
PERLODIDAE
PHAENOPSECTRA
PHAGOCATA
PHYSELLA
PISIDIUM
POLYCENTROPODIDAE
POLYPEDILUM
PROBEZZIA
PROCLADIUS
PROSIMULIUM
PROSTOIA
PSEPHENUS
PSEUDOLIMNOPHILA
PTILOSTOMIS
PYCNOPSYCHE
RHEOTANYTARSUS
SIMULIUM
SIPHLONURUS
SPHAERIIDAE
SPHAERIUM
SPIROSPERMA
STEGOPTERNA
STEMPELLINELLA
STENELMIS
STENONEMA
STROPHOPTERYX
SYNURELLA
TANYPODINAE
TANYTARSUS
THIENEMANNIELLA
TIPULA
TIPULIDAE
TUBIFICIDAE
TVETENIA
ZAVRELIMYIA

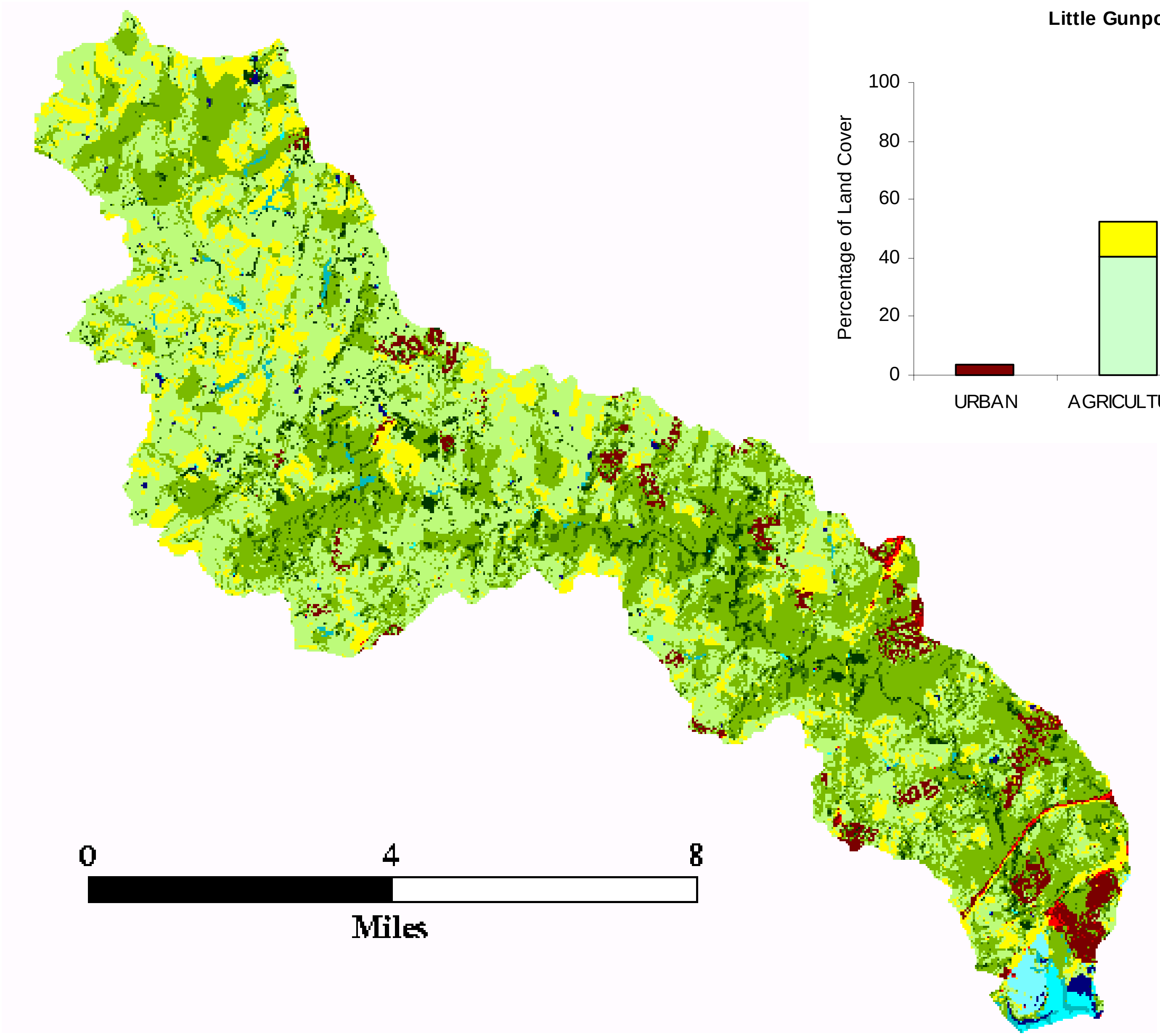
Herpetofauna Present

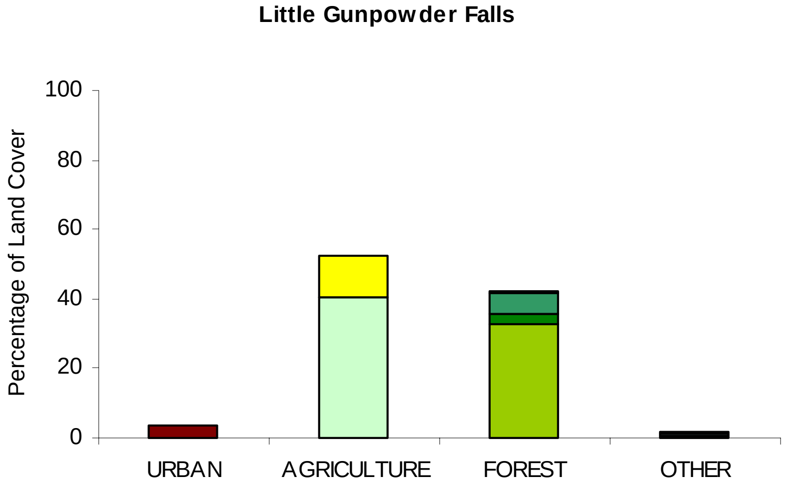
AMERICAN TOAD
BULLFROG
COMMON SNAPPING TURTLE
EASTERN BOX TURTLE
EASTERN MUD TURTLE
FOWLER'S TOAD
GREEN FROG
NORTHERN TWO-LINED SALAMANDER
PICKEREL FROG
SOUTHERN LEOPARD FROG
WOOD FROG

Little Gunpowder Falls watershed
MBSS 2001



Little Gunpowder Falls





Little Gunpowder Falls

Site Information

Site	Stream Name	12-Digit Subwatershed Code	8-digit Watershed	Basin	County	Date Sampled Spring	Date Sampled Summer	Order	Catchment Area (acres)
LIGU-102-R-2001	OVERSHOT BR	021308040298	Little Gunpowder Falls	GUNPOWDER RIVER	Harford	06-Mar-01	11-Jun-01	1	1047
LIGU-103-R-2001	LITTLE GUNPOWDER FALLS UT3	021308040298	Little Gunpowder Falls	GUNPOWDER RIVER	Baltimore City	06-Mar-01	6-Jun-01	1	583
LIGU-104-R-2001	WILD CAT BR UT1	021308040298	Little Gunpowder Falls	GUNPOWDER RIVER	Harford	07-Mar-01	6-Jun-01	1	47
LIGU-105-R-2001	LITTLE GUNPOWDER FALLS	021308040298	Little Gunpowder Falls	GUNPOWDER RIVER	Harford	06-Mar-01	6-Jun-01	1	182
LIGU-109-R-2001	LITTLE GUNPOWDER FALLS	021308040299	Little Gunpowder Falls	GUNPOWDER RIVER	Baltimore City	07-Mar-01	11-Jun-01	1	343
LIGU-110-R-2001	OVERSHOT BR	021308040298	Little Gunpowder Falls	GUNPOWDER RIVER	Harford	06-Mar-01	11-Jun-01	1	298
LIGU-111-R-2001	LITTLE GUNPOWDER FALLS UT2	021308040298	Little Gunpowder Falls	GUNPOWDER RIVER	Baltimore City	07-Mar-01	12-Jun-01	1	303
LIGU-201-R-2001	LITTLE GUNPOWDER FALLS	021308040299	Little Gunpowder Falls	GUNPOWDER RIVER	Harford	07-Mar-01	12-Jun-01	2	8580
LIGU-306-R-2001	LITTLE GUNPOWDER FALLS	021308040298	Little Gunpowder Falls	GUNPOWDER RIVER	Harford	06-Mar-01	16-Jul-01	3	1273
LIGU-312-R-2001	LITTLE GUNPOWDER FALLS	021308040298	Little Gunpowder Falls	GUNPOWDER RIVER	Harford	06-Mar-01	16-Jul-01	3	28219

Indicator Information

Site	FIBI	BIBI	PHI	Brook Trout Present	Black Water Stream
LIGU-102-R-2001	4.33	4.33	78.64	1	0
LIGU-103-R-2001	2.11	2.56	25.92	0	0
LIGU-104-R-2001	NR	1.67	3.22	0	0
LIGU-105-R-2001	NR	4.56	41.24	0	0
LIGU-109-R-2001	3.67	4.33	51.38	1	0
LIGU-110-R-2001	NR	3.22	21.49	0	0
LIGU-111-R-2001	3.22	4.11	13.85	0	0
LIGU-201-R-2001	4.56	4.33	76.14	0	0
LIGU-306-R-2001	4.78	3.89	88.29	0	0
LIGU-312-R-2001	4.33	4.56	91.90	0	0

Catchment Land Use Information

Site	Percent Urban	Percent Agriculture	Percent Forest	Percent Other	Percent Impervious Surface
LIGU-102-R-2001	6.89	48.21	44.00	0.90	1.78
LIGU-103-R-2001	5.25	53.81	40.78	0.16	1.42
LIGU-104-R-2001	1.99	33.77	64.24	0.00	0.83
LIGU-105-R-2001	31.71	17.42	50.70	0.17	8.01
LIGU-109-R-2001	0.18	75.32	22.75	1.74	0.09
LIGU-110-R-2001	12.37	64.27	21.25	2.11	3.25
LIGU-111-R-2001	1.97	78.50	19.52	0.00	0.65
LIGU-201-R-2001	0.15	71.09	28.21	0.56	0.05
LIGU-306-R-2001	10.34	43.21	46.23	0.22	3.53
LIGU-312-R-2001	1.78	58.72	39.07	0.43	0.47

Interpretation of Watershed Condition

- Most sites located in catchments with significant agricultural land use
- Nitrogen and phosphorus levels elevated at nearly all sites
- Chlorine high at several sites
- Physical habitat parameters generally good

Little Gunpowder Falls

Site	Closed pH	Specific Cond.	ANC (µeq/L)	Cl (mg/L)	Nitrate-N (mg/L)	SO4 (mg/L)	T-P (mg/L)	Ortho-P (mg/L)	Nitrite (mg/L)	Ammonia (mg/L)	T-N (mg/L)	DOC (mg/L)	DO (mg/L)	Turbidity (mg/L)
LIGU-102-R-2001	7.28	161.2	267.7	27.736	2.766	3.273	0.0082	0.001	0.0051	0.015	3.223	0.975	9.4	0.7
LIGU-103-R-2001	7.61	326.9	717.1	59.222	2.364	11.425	0.0110	0.010	0.0035	0.011	2.584	1.563	8.9	0.7
LIGU-104-R-2001	7.05	115.3	315.5	15.472	0.494	8.388	0.0059	0.001	0.0029	0.011	0.620	2.711	7.6	13
LIGU-105-R-2001	7.74	245.7	718.2	34.709	2.848	11.077	0.0083	0.009	0.0019	0.005	3.133	1.165	6	1.7
LIGU-109-R-2001	6.88	122.3	412.5	10.191	3.424	4.668	0.0287	0.005	0.0033	0.020	4.005	1.580	9.1	12.8
LIGU-110-R-2001	6.45	176.2	282.1	32.405	2.209	2.473	0.0158	0.001	0.0109	0.210	2.720	1.498	8.6	1.4
LIGU-111-R-2001	6.70	196.9	349.5	32.913	4.104	3.530	0.0104	0.001	0.0035	0.017	4.687	0.826	7.7	3.8
LIGU-201-R-2001	7.48	156.0	476.6	16.422	3.301	7.181	0.0293	0.012	0.0075	0.022	3.876	1.487	8.9	3.9
LIGU-306-R-2001	7.60	181.7	492.8	24.366	2.296	7.193	0.0297	0.023	0.0087	0.011	2.643	2.480	9	2.3
LIGU-312-R-2001	7.63	175.6	494.8	24.893	2.329	7.174	0.0307	0.010	0.0087	0.011	2.736	2.233	8.9	1.7

Physical Habitat Condition

Site	Riparian Buffer Width Left	Riparian Buffer Width Right	Adjacent Cover Left	Adjacent Cover Right	Instream Habitat Structure	Epifaunal Substrate	Velocity/ Depth Diversity	Pool/ Glide/ Eddy Quality	Extent of Pools (m)	Riffle/ Run Quality	Extent of Riffles (m)	Embed-dedness	Shading	Trash Rating	Maximum Depth (cm)
LIGU-102-R-2001	5	50	PV	FR	16	17	15	14	23	15	55	15	85	12	63
LIGU-103-R-2001	0	0	PA	PA	8	8	9	10	41	14	38	40	5	16	43
LIGU-104-R-2001	50	50	FR	FR	7	4	4	4	50	6	28	95	95	8	17
LIGU-105-R-2001	50	50	FR	FR	15	17	7	7	23	14	57	40	95	18	21
LIGU-109-R-2001	0	0	PA	PA	8	9	11	11	44	11	32	60	85	16	51
LIGU-110-R-2001	50	20	LN	PV	8	7	7	7	44	13	35	30	60	16	34
LIGU-111-R-2001	50	50	LN	LN	7	7	7	8	64	11	10	40	70	15	42
LIGU-201-R-2001	14	12	PA	PA	15	16	16	12	52	18	75	40	35	16	62
LIGU-306-R-2001	50	50	FR	FR	18	16	16	15	30	17	55	20	70	16	79
LIGU-312-R-2001	50	50	FR	FR	19	18	16	13	45	19	75	20	65	17	54

Physical Habitat Modifications

Site	Buffer Breaks?	Surface Mine?	Landfill?	Channelization?	Erosion Severity Left	Erosion Severity Right	Bar Formation
LIGU-102-R-2001	Y	N	N	Y	None	Mild	Minor
LIGU-103-R-2001	Y	N	N	N	Severe	Severe	Minor
LIGU-104-R-2001	N	N	N	N	Moderate	Moderate	Minor
LIGU-105-R-2001	N	N	N	N	Moderate	Moderate	Minor
LIGU-109-R-2001	Y	N	N	N	Moderate	Moderate	Minor
LIGU-110-R-2001	Y	N	N	N	Moderate	Mild	None
LIGU-111-R-2001	N	N	N	N	Moderate	Moderate	Moderate
LIGU-201-R-2001	N	N	N	N	Severe	Severe	None
LIGU-306-R-2001	N	N	N	N	Mild	Mild	Moderate
LIGU-312-R-2001	N	N	N	N	None	Mild	Minor

Little Gunpowder Falls

Stream Waders Data

Site	8-Digit Watershed	12-Digit Subwatershed	Stream Name	Benthic IBI
0298-6	Little Gunpowder Falls	021308040298	LITTLE GUNPOWDER FALLS	4.14
0298-3	Little Gunpowder Falls	021308040298	LITTLE GUNPOWDER FALLS	3.00
0298-4	Little Gunpowder Falls	021308040298	OVERSHOT BR	3.00
0298-10	Little Gunpowder Falls	021308040298		3.29
0298-8	Little Gunpowder Falls	021308040298	LITTLE GUNPOWDER FALLS	3.57
0298-1	Little Gunpowder Falls	021308040298	LITTLE GUNPOWDER FALLS UT	2.71
0299-2	Little Gunpowder Falls	021308040299	YELLOW BR	2.71
0299-7	Little Gunpowder Falls	021308040299	LITTLE GUNPOWDER FALLS	3.29
0298-5	Little Gunpowder Falls	021308040298	WILD CAT BR	2.71
0299-8	Little Gunpowder Falls	021308040299	LITTLE GUNPOWDER FALLS UT	4.43
0298-9	Little Gunpowder Falls	021308040298	LITTLE GUNPOWDER FALLS	4.71
0298-7	Little Gunpowder Falls	021308040298	LITTLE GUNPOWDER FALLS	3.86
0299-1	Little Gunpowder Falls	021308040299	LITTLE GUNPOWDER FALLS	4.14
0299-5	Little Gunpowder Falls	021308040299	LITTLE GUNPOWDER FALLS	2.71
0299-3	Little Gunpowder Falls	021308040299	LITTLE GUNPOWDER FALLS UT	3.57
0298-2	Little Gunpowder Falls	021308040298	LITTLE GUNPOWDER FALLS UT	1.86
0299-4	Little Gunpowder Falls	021308040299	THORNTON BR	3.86
0299-6	Little Gunpowder Falls	021308040299	SAWMILL BR	4.71

Little Gunpowder Falls

Fish Species Present

AMERICAN EEL
BLACKNOSE DACE
BLUEGILL
BROOK TROUT
COMMON SHINER
CREEK CHUB
CUTLIPS MINNOW
CYPRINID HYBRID
LONGNOSE DACE
MARGINED MADTOM
NORTHERN HOGSUCKER
REDBREAST SUNFISH
RIVER CHUB
ROSYFACE SHINER
ROSYSIDE DACE
SATINFIN SHINER
SEA LAMPREY
SHIELD DARTER
SMALLMOUTH BASS
SWALLOWTAIL SHINER
TESSELLATED DARTER
WHITE SUCKER

Exotic Plants Present

JAPANESE HONEYSUCKLE
MULTIFLORA ROSE
MILE-A-MINUTE
MICROSTEGIUM
PHRAGMITES
THISTLE

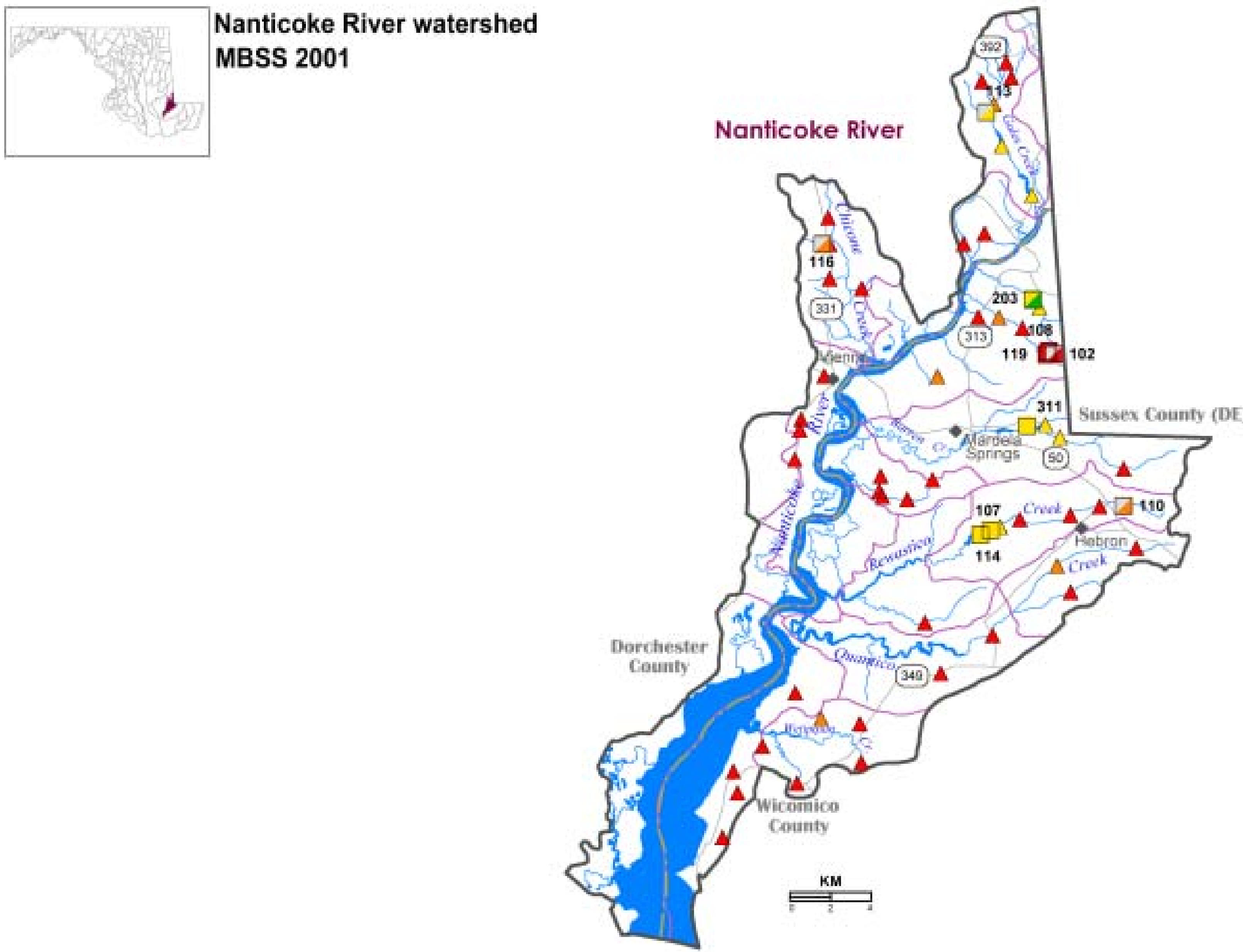
Benthic Taxa Present

ACENTRELLA
ACRONEURIA
ALLOCAPNIA
AMELETUS
AMPHINEMURA
ANCHYTARSUS
ANTOCHA
APSECTROTANYPUS
ARGIA
BAETIDAE
BOYERIA
BRILLIA
CALOPTERYX
CHEUMATOPSYCHE
CHIMARRA
CLINOCERA
CONCHAPELOPIA
CORIXIDAE
CORYNONEURA
CRICOTOPUS
CRICOTOPUS/ORTHOCLADIUS
CULICOIDES
DIAMESA
DICRANOTA
DIPLECTRONA
DIPLOCLADIUS
DOLICHOPODIDAE
DOLOPHILODES
DUBIRAPHIA
DUGESIA
ECCOPTURA
ELMIDAE
ENCHYTRAEIDAE
EPEORUS
EPHEMERELLA
EUKIEFFERIELLA
EURYLOPHELLA
FERRISSIA
GLOSSOSOMA
GOMPHIDAE
HELICHUS
HEMERODROMIA
HEPTAGENIIDAE
HETEROTRISSOCLADIUS
HEXATOMA
HYDROBAENUS
HYDROPORUS
HYDROPSYCHE
IRONOQUIA
ISONYCHIA
LEPTOPHLEBIA
LEPTOPHLEBIIDAE
LEPTOXIS
LEUCOTRICHIA
LEUCTRIDAE
LUMBRICULIDAE
LYPE
MACRONYCHUS
MEROPELOPIA
MICROPSECTRA
MICROTENDIPES
MICROVELIA
NAIDIDAE
NANOCLADIUS
NEMOURIDAE
NEOPHYLAX
NIGRONIA
OEMOPTERYX
OPTIOSERVUS
ORTHOCLADIINAE A
ORTHOCLADIUS
OSTROCERCA
OULIMNIUS
PAGASTIA
PARACHAETOCLADIUS
PARACLADOPELMA
PARALEPTOPHLEBIA
PARAMETRIOCNEMUS
PARATANYTARSUS
PERLIDAE
PERLODIDAE
PHYSELLA
POLYCENTROPODIDAE
POLYCENTROPUS
POLYPEDILUM
POTTHASTIA
PROBEZZIA
PROCLADIUS
PROCLOEON
PROSIMULIUM
PROSTOIA
PROSTOMA
PSEPHENUS
PSEUDOLIMNOPHILA
PSEUDORTHOCLADIUS
PYCNOPSYCHE
RHEOTANYTARSUS
RHYACOPHILA
SERRATELLA
SIALIS
SIMULIIDAE
SIMULIUM
SPHAERIIDAE
SPIROSPERMA
STAGNICOLA
STEGOPTERNA
STEMPELLINELLA
STENELMIS
STENONEMA
STROPHOPTERYX
SYMPOSIOCLADIUS
SYMPOTTHASTIA
TAENIOPTERYX
TALLAPERLA
TANYPODINAE
TANYTARSUS
THIENEMANNIELLA
TIPULA
TRISSOPELOPIA
TUBIFICIDAE
TURBELLARIA
TVETENIA
ZAVRELIMYIA

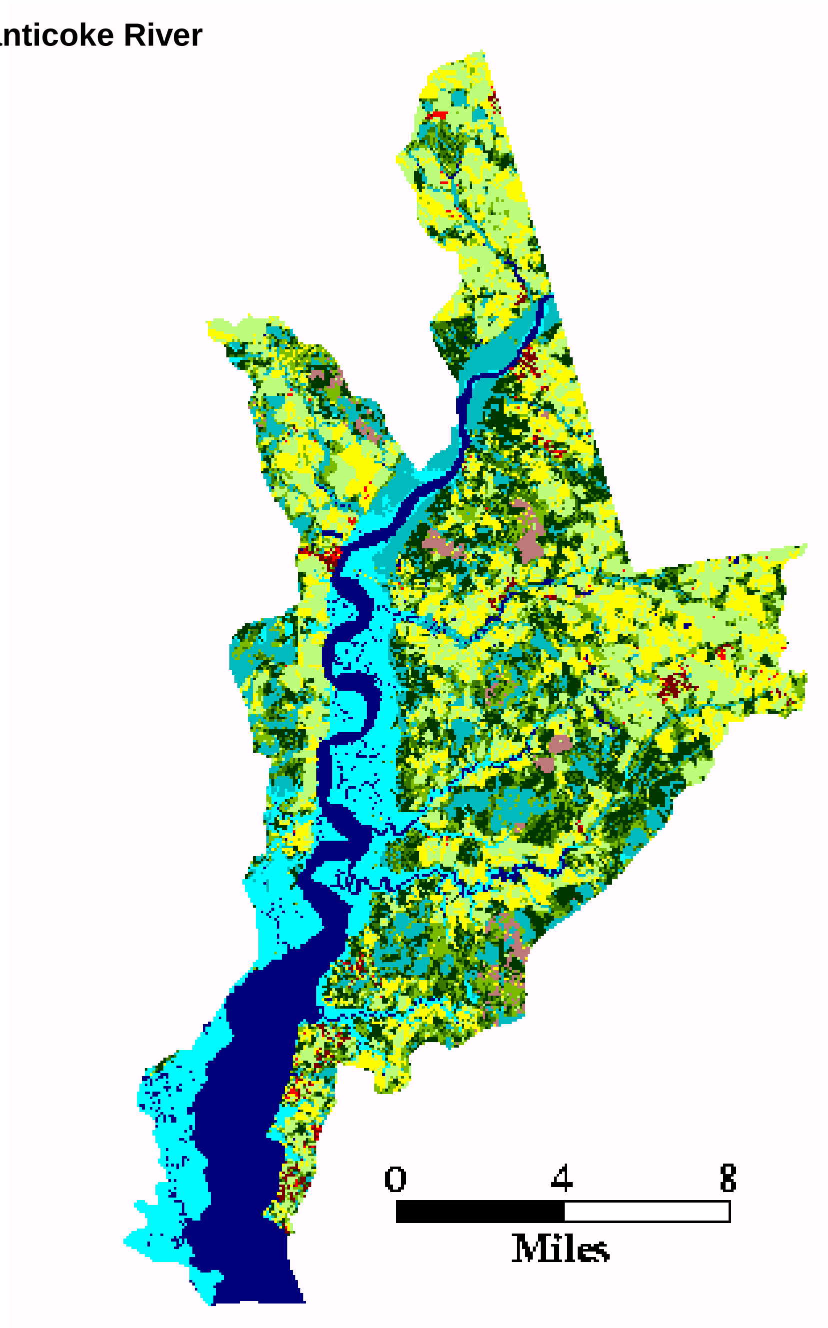
Herpetofauna Present

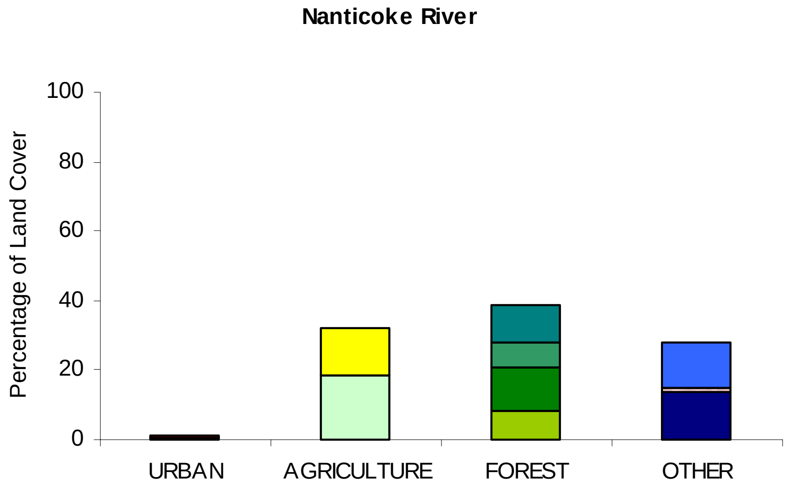
AMERICAN TOAD
BULLFROG
COMMON SNAPPING TURTLE
EASTERN BOX TURTLE
EASTERN PAINTED TURTLE
GREEN FROG
LONGTAIL SALAMANDER
NORTHERN TWO-LINED SALAMANDER
PICKEREL FROG
RED SALAMANDER

Nanticoke River watershed
MBSS 2001



Nanticoke River





Nanticoke River

Site Information

Site	Stream Name	12-Digit Subwatershed Code	8-digit Watershed	Basin	County	Date Sampled Spring	Date Sampled Summer	Order	Catchment Area (acres)
NANT-102-R-2001	NANTICOKE R UT1	021303050584	Nanticoke River	NANTICOKE RIVER	Wicomico	07-Mar-01	5-Jun-01	1	236
NANT-107-R-2001	REWASTICO CR	021303050581	Nanticoke River	NANTICOKE RIVER	Wicomico	12-Mar-01	23-Jul-01	1	5888
NANT-108-R-2001	NANTICKE R UT1 UT1	021303050584	Nanticoke River	NANTICOKE RIVER	Wicomico	07-Mar-01	5-Jun-01	1	303
NANT-110-R-2001	REWASTICO CR	021303050581	Nanticoke River	NANTICOKE RIVER	Wicomico	12-Mar-01	23-Jul-01	1	1077
NANT-113-R-2001	GALES CR UT1	021303050588	Nanticoke River	NANTICOKE RIVER	Dorchester	07-Mar-01	24-Aug-01	1	494
NANT-114-R-2001	REWASTICO CR	021303050581	Nanticoke River	NANTICOKE RIVER	Wicomico	12-Mar-01	24-Aug-01	1	6807
NANT-116-R-2001	CHICONE CR UT1	021303050586	Nanticoke River	NANTICOKE RIVER	Dorchester	07-Jun-01	5-Jun-01	1	144
NANT-119-R-2001	UT NANTICOKE R UT1 UT1	021303050584	Nanticoke River	NANTICOKE RIVER	Wicomico	07-Mar-01	5-Jun-01	1	810
NANT-203-R-2001	PLUM CR	021303050584	Nanticoke River	NANTICOKE RIVER	Wicomico	07-Mar-01	5-Jun-01	2	1865
NANT-311-R-2001	BARREN CR	021303050583	Nanticoke River	NANTICOKE RIVER	Wicomico	12-Mar-01	22-Aug-01	3	9706

Indicator Information

Site	FIBI	BIBI	PHI	Brook Trout Present	Black Water Stream
NANT-102-R-2001	NR	1.57	26.14	0	0
NANT-107-R-2001	3.75	3.86	85.71	0	0
NANT-108-R-2001	1.50	1.57	38.30	0	0
NANT-110-R-2001	NR	2.14	72.86	NS	NS
NANT-113-R-2001	NS	3.00	NS	NS	NS
NANT-114-R-2001	3.00	3.29	93.67	0	0
NANT-116-R-2001	NR	2.71	6.10	0	1
NANT-119-R-2001	1.00	1.86	48.26	0	0
NANT-203-R-2001	3.25	4.14	88.43	0	0
NANT-311-R-2001	3.25	3.29	95.88	0	0

Catchment Land Use Information

Site	Percent Urban	Percent Agriculture	Percent Forest	Percent Other	Percent Impervious Surface
NANT-102-R-2001	0.13	79.79	20.08	0.00	0.10
NANT-107-R-2001	3.07	64.17	30.74	2.02	1.27
NANT-108-R-2001	0.10	69.41	30.49	0.00	0.08
NANT-110-R-2001	3.72	75.85	20.40	0.03	2.01
NANT-113-R-2001	0.38	67.92	31.63	0.06	0.29
NANT-114-R-2001	2.67	60.91	34.62	1.81	1.10
NANT-116-R-2001	0.00	45.18	54.82	0.00	0.00
NANT-119-R-2001	0.00	31.24	68.76	0.00	0.00
NANT-203-R-2001	0.56	79.84	19.46	0.14	0.42
NANT-311-R-2001	0.31	63.52	34.96	1.21	0.22

Interpretation of Watershed Condition

- Many sites located in highly agricultural areas
- Elevated nitrogen and phosphorus at nearly all sites
- ANC low at many sites
- Poor riffle/run quality may be indicative of natural conditions on the Eastern Shore
- Site 110 contained extremely soft substrate and was infested with algae and garbage
- Sites are either small ditches or very wide channels, both with very little flow

Nanticoke River

Water Chemistry Information

Site	Closed pH	Specific Cond.	ANC (µeq/L)	Cl (mg/L)	Nitrate-N (mg/L)	SO4 (mg/L)	T-P (mg/L)	Ortho-P (mg/L)	Nitrite (mg/L)	Ammonia (mg/L)	T-N (mg/L)	DOC (mg/L)	DO (mg/L)	Turbidity (mg/L)
NANT-102-R-2001	5.36	86.5	52.6	8.022	2.157	8.521	0.0099	0.006	0.0018	0.043	2.551	5.742	4.2	1.3
NANT-107-R-2001	6.92	154.0	306.3	12.921	4.425	11.347	0.0203	0.001	0.0108	0.017	4.788	2.713	7.5	2.2
NANT-108-R-2001	6.13	206.2	108.6	14.229	12.143	12.206	0.0215	0.001	0.0071	0.005	12.183	3.126	9.6	4.9
NANT-110-R-2001	6.56	94.3	264.9	8.140	2.646	3.503	0.0091	0.001	0.0056	0.018	3.002	1.397	7.3	340
NANT-113-R-2001	6.64	152.9	228.0	12.129	7.043	7.371	0.0121	0.006	0.0044	0.011	7.231	3.566	NS	NS
NANT-114-R-2001	6.88	149.7	293.8	13.116	4.057	11.783	0.0204	0.001	0.0089	0.022	4.716	3.245	6.7	2.8
NANT-116-R-2001	5.64	185.8	47.1	11.802	6.559	25.701	0.0160	0.003	0.0010	0.339	7.429	11.642	7.5	6.7
NANT-119-R-2001	5.25	58.5	22.5	5.844	0.123	9.734	0.0096	0.001	0.0004	0.010	0.232	4.291	4.5	0.9
NANT-203-R-2001	6.32	129.3	156.4	11.408	5.761	6.045	0.0080	0.007	0.0031	0.004	6.039	1.786	7.4	1.7
NANT-311-R-2001	6.68	111.4	216.5	11.036	3.576	5.323	0.0168	0.004	0.0044	0.013	4.144	2.568	6.8	2.8

Physical Habitat Condition

Site	Riparian Buffer Width Left	Riparian Buffer Width Right	Adjacent Cover Left	Adjacent Cover Right	Instream Habitat Structure	Epifaunal Substrate	Velocity/ Depth Diversity	Pool/ Glide/ Eddy Quality	Extent of Pools (m)	Riffle/ Run Quality	Extent of Riffles (m)	Embed-dedness	Shading	Trash Rating	Maximum Depth (cm)
NANT-102-R-2001	50	50	FR	FR	10	11	5	9	75	0	0	100	95	19	31
NANT-107-R-2001	50	50	FR	FR	16	14	15	17	65	5	10	100	95	15	68
NANT-108-R-2001	50	50	FR	FR	12	12	9	11	75	0	0	100	95	9	52
NANT-110-R-2001	50	50	FR	LN	18	16	6	19	75	0	0	100	90	6	90
NANT-113-R-2001	40	22	CP	CP	NS	NS	NS	NS	NS	NS	NS	NS	NS	17	NS
NANT-114-R-2001	50	50	FR	FR	17	16	15	18	47	16	32	70	90	17	90
NANT-116-R-2001	50	0	FR	CP	2	3	4	4	75	0	0	100	80	20	12
NANT-119-R-2001	50	50	FR	FR	10	11	9	12	75	0	0	100	95	18	54
NANT-203-R-2001	50	20	FR	SL	15	15	14	17	23	16	64	100	97	17	100
NANT-311-R-2001	50	50	FR	FR	18	16	17	17	47	18	38	80	96	18	116

Physical Habitat Modifications

Site	Buffer Breaks?	Surface Mine?	Landfill?	Channelization?	Erosion Severity Left	Erosion Severity Right	Bar Formation
NANT-102-R-2001	N	N	N	N	None	None	None
NANT-107-R-2001	N	N	N	N	None	None	Minor
NANT-108-R-2001	N	N	N	N	None	None	None
NANT-110-R-2001	Y	N	N	N	None	None	1.None
NANT-113-R-2001	N	N	N	N	NS	NS	NS
NANT-114-R-2001	N	N	N	N	None	None	Moderate
NANT-116-R-2001	Y	N	N	Y	None	Severe	Minor
NANT-119-R-2001	N	N	N	Y	Mild	Mild	None
NANT-203-R-2001	N	N	N	N	None	None	Minor
NANT-311-R-2001	N	Y	N	N	None	None	None

Nanticoke River

Stream Waders Data

Nanticoke River

Stream Waders Data

Site	8-Digit Watershed	12-Digit Subwatershed	Stream Name	Benthic IBI
0572-4	Nanticoke River	021303050573		1.86
0582-3	Nanticoke River	021303050582	INGEM GUT	1.86
0572-3	Nanticoke River	021303050572		1.29
0572-1	Nanticoke River	021303050572	WINDSOR CR	1.57
0572-2	Nanticoke River	021303050572	DUNN CR	1.86
0582-4	Nanticoke River	021303050582	INGEM GUT	1.57
0574-1	Nanticoke River	021303050577	MANUMSCO CR	1.86
0582-5	Nanticoke River	021303050582	INGEM GUT	1.57
0584-2	Nanticoke River	021303050584	GRIIMES CR UT	2.14
0574-3	Nanticoke River	021303050574	GUNMILL CR	1.86
0587-2	Nanticoke River	021303050587	MOLLY HORN BR WESTERN FEEDER	1.57
0584-3	Nanticoke River	021303050584	PLUM CR	1.57
0588-5	Nanticoke River	021303050588	GALES CR UT	1.57
0587-1	Nanticoke River	021303050587	MOLLY HORN BR	1.86
0574-2	Nanticoke River	021303050574	QUANTICO CR	1.57
0588-6	Nanticoke River	021303050588	SPILLWAY OF WRIGHTSMILL POND	2.71
0584-4	Nanticoke River	021303050584	PLUM CR	2.71
0573-3	Nanticoke River	021303050573	WETIPQUIN CR	1.57
0588-2	Nanticoke River	021303050588	GALES CR	3.29
0588-4	Nanticoke River	021303050588	WRIGHTS MILL POND BR	1.29
0588-3	Nanticoke River	021303050588	GALES CR UT	1.29
0581-4	Nanticoke River	021303050581	REWASTACO CR	1.57
0584-1	Nanticoke River	021303050584	NANTICOKE R UT	1.57
0588-1	Nanticoke River	021303050588	GALES CR	3.00
0584-5	Nanticoke River	021303050584	PLUM CR	3.86
0583-4	Nanticoke River	021303050583	BARREN CR UT	3.57
0580-1	Nanticoke River	021303050580	QUANTICO CR	2.43
0583-3	Nanticoke River	021303050583	BARREN CR UT	3.00
0581-5	Nanticoke River	021303050581	REWASTACO CR	1.86
0580-2	Nanticoke River	021303050580	PETERS CR	1.86
0581-2	Nanticoke River	021303050581	REWASTACO CR	1.57
0581-1	Nanticoke River	021303050581	BARREN CR UT	1.00
0583-1	Nanticoke River	021303050583	BARREN CR	1.29
0580-3	Nanticoke River	021303050580	QUANTICO CR	1.29
0573-2	Nanticoke River	021303050573	WILLINGS GUT	1.57
0582-1	Nanticoke River	021303050582		1.86
0572-5	Nanticoke River	021303050572		1.57
0573-4	Nanticoke River	021303050573		1.57
0582-2	Nanticoke River	021303050582	INGEM GUT	1.86
0578-3	Nanticoke River	021303050578	SOUTH BR MILL CR	1.57
0578-4	Nanticoke River	021303050578	NORTH BR MILL CR	1.57
0573-1	Nanticoke River	021303050573	HORNER GUT	2.14
0578-5	Nanticoke River	021303050578		1.57
0586-1	Nanticoke River	021303050586	CHICONE CR	1.57
0586-4	Nanticoke River	021303050586	CHICONE CR UT	1.57
0586-2	Nanticoke River	021303050586	CHICONE CR UT	1.00
Site	**8-Digit Watershed**	**12-Digit Subwatershed**	**Stream Name**	**Benthic IBI**
0586-3	Nanticoke River	021303050586	CHICONE CR UT	1.57
0581-3	Nanticoke River	021303050581	REWASTICO CR	3.00

Nanticoke River

Stream Waders Data

0581-3	Nanticoke River	021303050581	REWASTICO CR	3.00
0578-2	Nanticoke River	021303050578		1.86

Nanticoke River

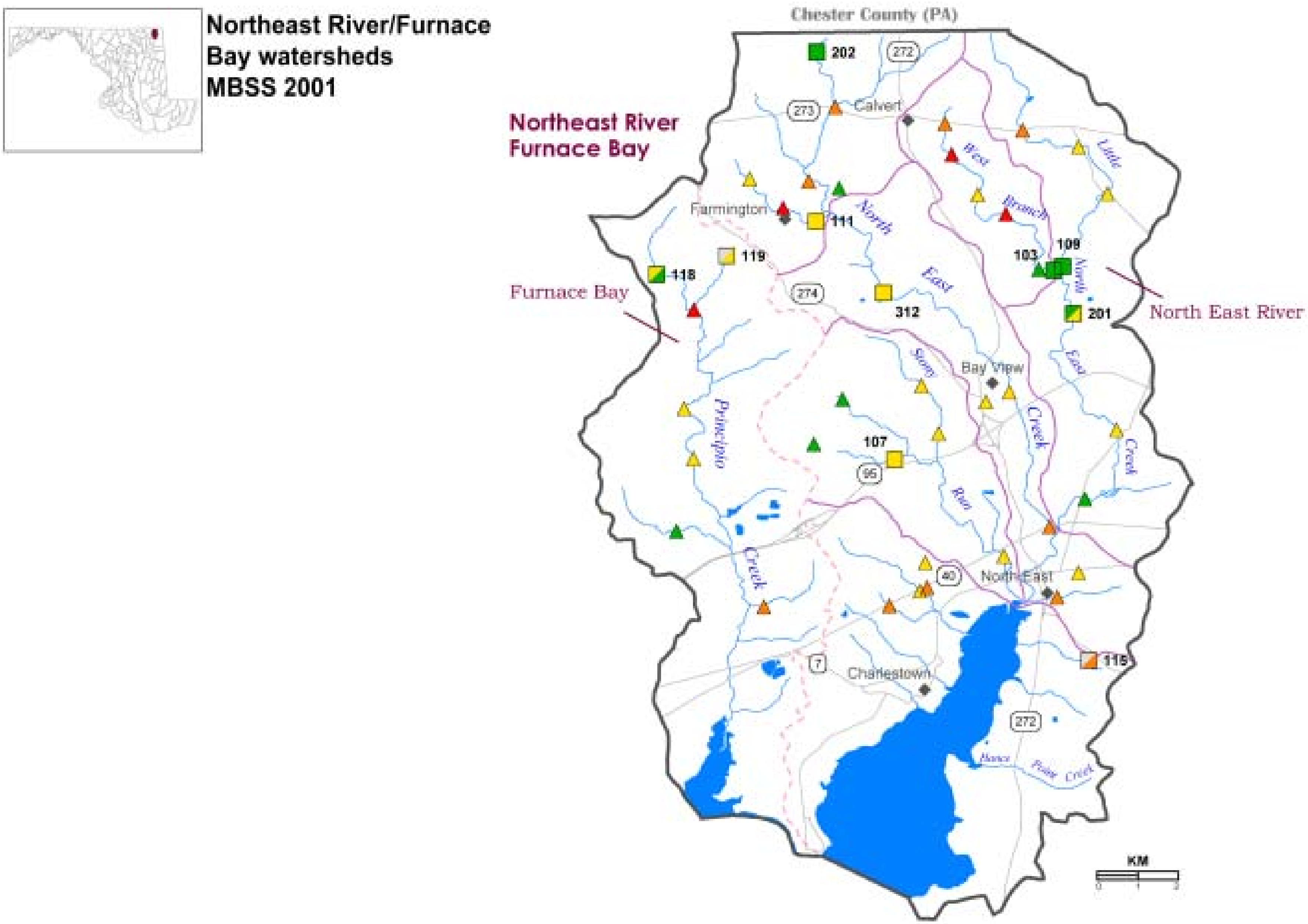
Fish Species Present
AMERICAN EEL
BLUEGILL
BLUESPOTTED SUNFISH
BROWN BULLHEAD
CHAIN PICKEREL
CREEK CHUBSUCKER
EASTERN MUDMINNOW
LARGEMOUTH BASS
LEAST BROOK LAMPREY
MARGINED MADTOM
MOSQUITOFISH
PIRATE PERCH
PUMPKINSEED
SWAMP DARTER
TESSELLATED DARTER
YELLOW BULLHEAD

Exotic Plants Present
JAPANESE HONEYSUCKLE
MULTIFLORA ROSE

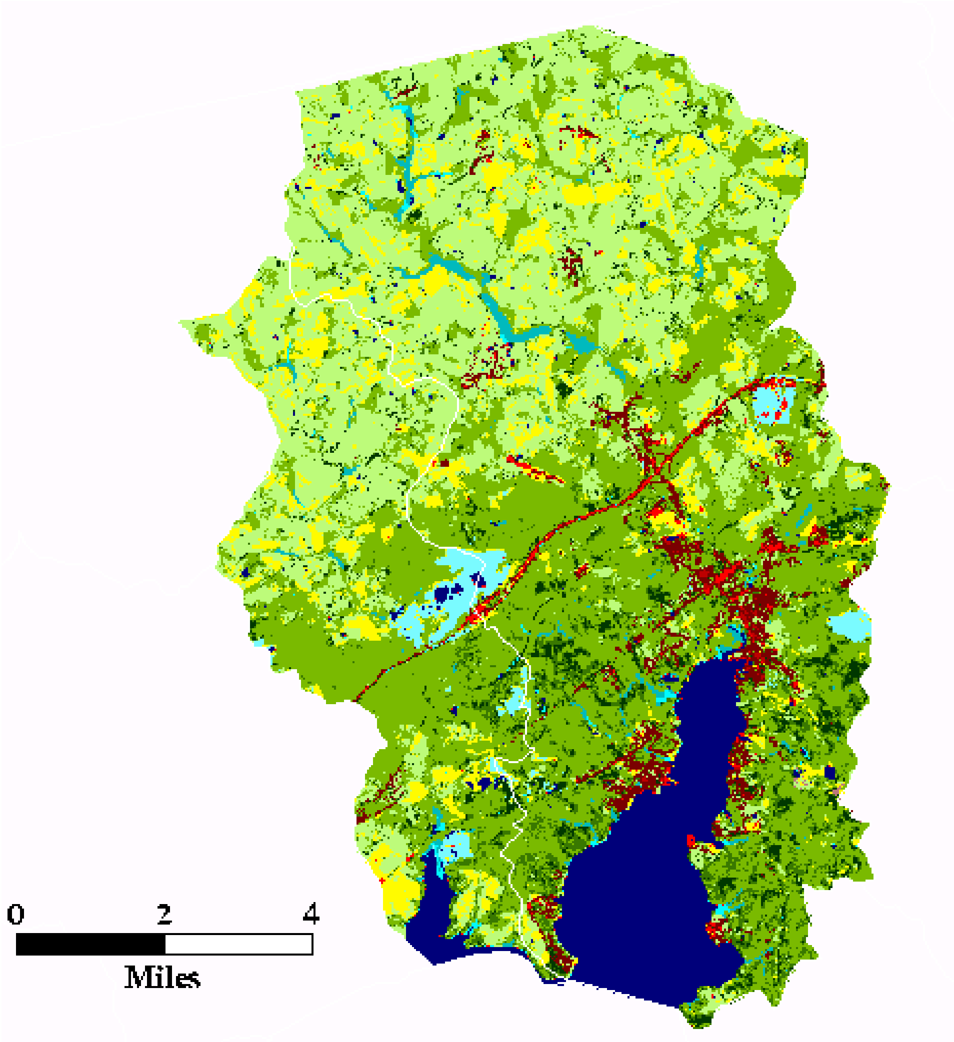
Benthic Taxa Present
ABLABESMYIA
AEDES
APSECTROTANYPUS
BEZZIA
BOYERIA
BRILLIA
CAECIDOTEA
CALOPTERYX
CHAULIODES
CHELIFERA
CHEUMATOPSYCHE
CHIRONOMINI
COENAGRIONIDAE
CONCHAPELOPIA
CORDULIIDAE
CORYNONEURA
CRANGONYX
CRICOTOPUS
CRICOTOPUS/ORTHOCLADIUS
CULICIDAE
DICRANOTA
DIPLECTRONA
DIPLOCLADIUS
DIPTERA
DOLICHOPODIDAE
ELMIDAE
ENDOCHIRONOMUS
EURYLOPHELLA
GAMMARUS
GOMPHIDAE
HEMERODROMIA
HYDROBAENUS
HYDROPORUS
HYDROPSYCHE
IRONOQUIA
LABRUNDINIA
LACCORNIS
LARSIA
LEPIDOSTOMA
LEPTOCERIDAE
LEPTOPHLEBIA
LEUCTRIDAE
LIMNEPHILIDAE
LIMNOPHYES
LUMBRICULIDAE
LYPE
MENETUS
MEROPELOPIA
MESOSMITTIA
MICROPSECTRA
MICROTENDIPES
NAIDIDAE
NANOCLADIUS
NEMOURIDAE
ORTHOCLADIINAE
PARAMERINA
PARAMETRIOCNEMUS
PARATANYTARSUS
PARATENDIPES
PHYSELLA
PLACOBDELLA
POLYCENTROPODIDAE
POLYPEDILUM
POTTHASTIA
PRODIAMESA
PSEUDOLIMNOPHILA
PTILOSTOMIS
RHEOCRICOTOPUS
RHEOTANYTARSUS
SIMULIUM
SPHAERIIDAE
STEGOPTERNA
STEMPELLINELLA
STENONEMA
STICTOCHIRONOMUS
SYMPOSIOCLADIUS
SYNURELLA
TAENIOPTERYX
TANYPODINAE
TANYTARSUS
THIENEMANNIELLA
TIPULA
TRIBELOS
TUBIFICIDAE
TVETENIA
ZAVRELIMYIA

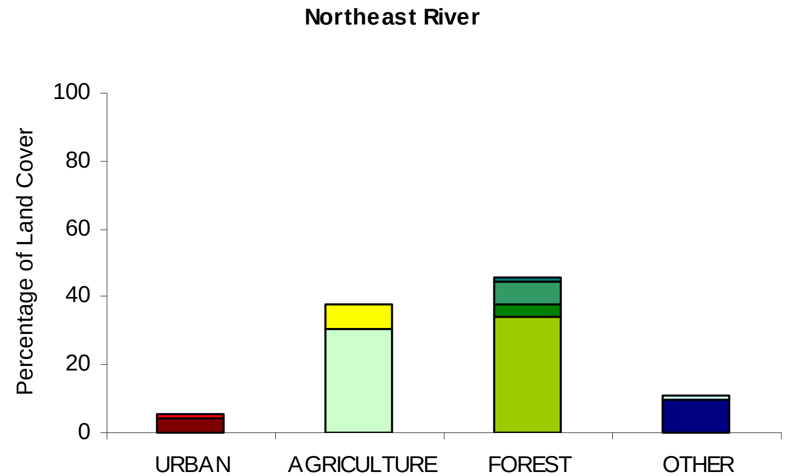
Herpetofauna Present
BULLFROG
EASTERN PAINTED TURTLE
FOWLER'S TOAD
GREEN FROG
PICKEREL FROG
SOUTHERN LEOPARD FROG

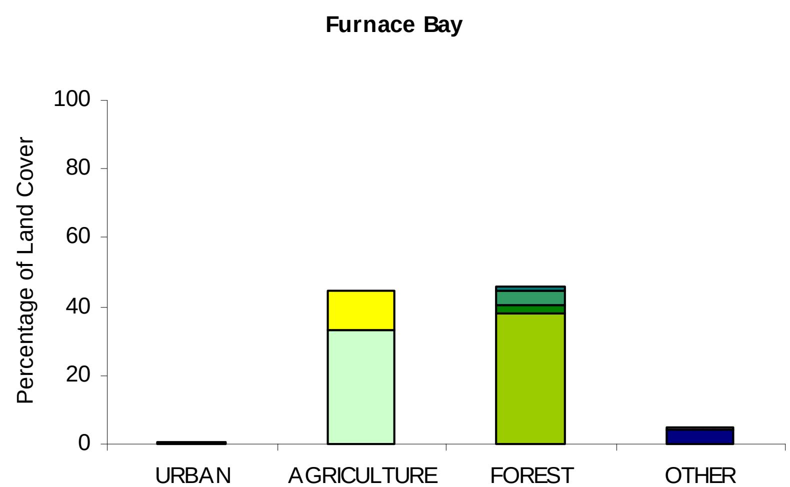
Northeast River/Furnace Bay watersheds
MBSS 2001



Northeast River/Furnace Bay







Northeast River/Furnace Bay

Site Information

Site	Stream Name	12-Digit Subwatershed Code	8-digit Watershed	Basin	County	Date Sampled Spring	Date Sampled Summer	Order	Catchment Area (acres)
FURN-118-R-2001	PRINCIPIO CR	021306090380	Furnace Bay	ELK RIVER	Cecil	20-Mar-01	24-Jul-01	1	738
FURN-119-R-2001	PRINCIPIO CR UT1	021306090380	Furnace Bay	ELK RIVER	Cecil	20-Mar-01	18-Jun-01	1	168
NEAS-103-R-2001	WEST BR NORTHEAST CR	021306080378	Northeast River	ELK RIVER	Cecil	16-Mar-01	19-Jun-01	1	2977
NEAS-107-R-2001	STONY RUN UT1 UT1	021306080375	Northeast River	ELK RIVER	Cecil	15-Mar-01	21-Jun-01	1	1314
NEAS-109-R-2001	LITTLE NORTHEAST CR	021306080377	Northeast River	ELK RIVER	Cecil	16-Mar-01	19-Jun-01	1	4224
NEAS-111-R-2001	NORTHEAST CR UT1	021306080379	Northeast River	ELK RIVER	Cecil	19-Mar-01	23-Jul-01	1	1497
NEAS-115-R-2001	NORTHEAST RIVER UT1	021306080374	Northeast River	ELK RIVER	Cecil	19-Mar-01	19-Jun-01	1	152
NEAS-201-R-2001	LITTLE NORTHEAST CR	021306080377	Northeast River	ELK RIVER	Cecil	19-Mar-01	20-Jun-01	2	7687
NEAS-202-R-2001	NORTHEAST CR	021306080379	Northeast River	ELK RIVER	Cecil	19-Mar-01	18-Jun-01	2	4293
NEAS-312-R-2001	NORTHEAST CR	021306080376	Northeast River	ELK RIVER	Cecil	19-Mar-01	31-Jul-01	3	12704

Indicator Information

Site	FIBI	BIBI	PHI	Brook Trout Present	Black Water Stream
FURN-118-R-2001	3.44	4.33	22.54	0	0
FURN-119-R-2001	NR	3.89	48.82	0	0
NEAS-103-R-2001	4.56	4.33	75.70	0	0
NEAS-107-R-2001	3.22	3.89	55.95	0	0
NEAS-109-R-2001	4.11	4.33	99.74	0	0
NEAS-111-R-2001	3.22	3.44	8.31	0	0
NEAS-115-R-2001	NS	2.14	NS	NS	NS
NEAS-201-R-2001	4.11	3.67	87.23	0	0
NEAS-202-R-2001	4.11	4.11	53.93	0	0
NEAS-312-R-2001	3.44	3.89	96.68	0	0

Catchment Land Use Information

Site	Percent Urban	Percent Agriculture	Percent Forest	Percent Other	Percent Impervious Surface
FURN-118-R-2001	0.09	82.38	17.36	0.17	0.43
FURN-119-R-2001	0.00	86.20	13.80	0.00	0.00
NEAS-103-R-2001	1.41	77.23	21.03	0.33	0.52
NEAS-107-R-2001	3.62	17.05	70.07	9.27	1.74
NEAS-109-R-2001	0.16	72.26	26.90	0.68	0.06
NEAS-111-R-2001	0.17	86.43	12.71	0.69	0.13
NEAS-115-R-2001	0.00	3.51	96.49	0.00	0.00
NEAS-201-R-2001	0.64	72.89	25.94	0.52	0.24
NEAS-202-R-2001	0.95	75.84	21.91	1.29	0.36
NEAS-312-R-2001	1.04	76.31	21.39	1.26	0.38

Interpretation of Watershed Condition

- Most sites located in catchments with significant amounts of agricultural land
- Nitrogen and phosphorus levels are elevated at nearly all sites
- Physical habitat parameters are generally good
- Sites 107 and 115 have low ANC values
- Site 115 is in a golf course, 96% forested

Northeast River/Furnace Bay

Water Chemistry Information

Site	Closed pH	Specific Cond.	ANC (µeq/L)	Cl (mg/L)	Nitrate-N (mg/L)	SO4 (mg/L)	T-P (mg/L)	Ortho-P (mg/L)	Nitrite (mg/L)	Ammonia (mg/L)	T-N (mg/L)	DOC (mg/L)	DO (mg/L)	Turbidity (mg/L)
FURN-118-R-2001	7.47	219.7	746.3	22.607	3.451	10.384	0.0717	0.054	0.0200	0.028	4.147	2.928	7.6	5.8
FURN-119-R-2001	7.54	257.5	508.2	20.843	4.434	11.324	0.0455	0.043	0.0101	0.014	4.914	2.118	8.2	4.2
NEAS-103-R-2001	7.71	224.6	495.2	34.162	2.304	11.967	0.0511	0.018	0.0084	0.006	2.621	4.404	8	4.8
NEAS-107-R-2001	6.86	158.4	179.0	32.332	0.409	7.112	0.0105	0.001	0.0004	0.018	0.536	2.510	8.1	5.7
NEAS-109-R-2001	7.55	206.8	459.5	31.246	2.186	11.505	0.0539	0.015	0.0113	0.016	2.633	4.503	6.8	4.4
NEAS-111-R-2001	7.26	195.7	611.2	16.788	3.665	13.409	0.0770	0.053	0.0261	0.062	4.140	2.691	7.6	12.2
NEAS-115-R-2001	4.46	110.8	-24.7	19.219	0.114	10.572	0.0067	0.001	0.0004	0.004	0.144	3.787	NS	NS
NEAS-201-R-2001	7.61	203.8	517.5	23.694	2.666	13.032	0.0306	0.012	0.0139	0.009	3.254	3.706	8.1	3.9
NEAS-202-R-2001	8.94	199.6	818.1	16.164	3.368	9.711	0.0902	0.069	0.0201	0.031	3.499	5.257	7.8	12
NEAS-312-R-2001	7.39	215.0	801.0	21.235	3.137	11.233	0.0773	0.040	0.0306	0.058	3.554	3.635	9.6	5.6

Physical Habitat Condition

Site	Riparian Buffer Width Left	Riparian Buffer Width Right	Adjacent Cover Left	Adjacent Cover Right	Instream Habitat Structure	Epifaunal Substrate	Velocity/ Depth Diversity	Pool/ Glide/ Eddy Quality	Extent of Pools (m)	Riffle/ Run Quality	Extent of Riffles (m)	Embed-dedness	Shading	Trash Rating	Maximum Depth (cm)
FURN-118-R-2001	13	50	CP	FR	8	9	11	13	45	11	30	35	93	4	62
FURN-119-R-2001	50	40	FR	CP	11	11	12	13	68	11	9	35	98	12	130
NEAS-103-R-2001	50	50	FR	FR	16	17	15	16	51	16	28	25	85	17	97
NEAS-107-R-2001	50	50	FR	FR	9	8	12	16	75	11	5	55	65	13	90
NEAS-109-R-2001	50	50	FR	FR	15	15	14	16	52	14	30	39	85	16	101
NEAS-111-R-2001	20	30	CP	CP	7	4	7	14	75	0	0	100	78	16	84
NEAS-115-R-2001	50	50	LN	FR	NS	NS	NS	NS	NS	NS	NS	NS	NS	14	NS
NEAS-201-R-2001	50	20	FR	PV	19	18	17	13	30	19	75	38	91	16	58
NEAS-202-R-2001	50	50	FR	LN	11	9	14	14	65	14	15	45	65	14	105
NEAS-312-R-2001	50	50	FR	FR	12	7	8	15	75	0	0	80	75	16	110

Physical Habitat Modifications

Site	Buffer Breaks?	Surface Mine?	Landfill?	Channelization?	Erosion Severity Left	Erosion Severity Right	Bar Formation
FURN-118-R-2001	N	N	N	N	Severe	Severe	Moderate
FURN-119-R-2001	N	N	N	N	Moderate	Moderate	Severe
NEAS-103-R-2001	N	N	N	N	Moderate	Moderate	Moderate
NEAS-107-R-2001	N	N	N	N	Moderate	Moderate	Minor
NEAS-109-R-2001	N	N	N	N	Moderate	Moderate	Moderate
NEAS-111-R-2001	N	N	N	N	Severe	Severe	Minor
NEAS-115-R-2001	N	N	N	N	NS	NS	NS
NEAS-201-R-2001	N	N	N	N	Mild	Mild	Minor
NEAS-202-R-2001	N	N	N	N	Mild	Mild	None
NEAS-312-R-2001	N	N	N	N	Severe	Severe	None

Northeast River/Furnace Bay

Stream Waders Data

Site	8-Digit Watershed	12-Digit Subwatershed	Stream Name	Benthic IBI
0380-1	Furnace Bay	021306090380	PRINCIPIO CR	1.86
0380-2	Furnace Bay	021306090380	PRINCIPIO CR	3.86
0380-3	Furnace Bay	021306090380	PRINCIPIO CR	3.86
0380-5	Furnace Bay	021306090380	PRINCIPIO CR UT	2.71
0380-4	Furnace Bay	021306090380	PRINCIPIO CR UT	5.00
0377-2	Northeast River	021306080377		3.86
0377-1	Northeast River	021306080377		4.14
0377-3	Northeast River	021306080377	LITTLE NORTHEAST CR	3.57
0376-4	Northeast River	021306080376		3.29
0375-1	Northeast River	021306080375		3.86
0376-3	Northeast River	021306080376		2.43
0377-4	Northeast River	021306080377	LITTLE NORTHEAST CR	3.00
0376-2	Northeast River	021306080376	NORTHEAST CR	2.43
0378-5	Northeast River	021306080378	WEST BR	4.43
0377-5	Northeast River	021306080377	LITTLE NORTHEAST CR	2.71
0376-1	Northeast River	021306080376	NORTHEAST CR	3.00
0378-4	Northeast River	021306080378	WEST BR	1.57
0379-4	Northeast River	021306080379	NORTHEAST CR	2.71
0375-5	Northeast River	021306080375		3.29
0376-5	Northeast River	021306080376	NORTHEAST CR UT	3.86
0378-2	Northeast River	021306080378	WEST BR	3.00
0378-3	Northeast River	021306080378	WEST BR	1.86
0378-1	Northeast River	021306080378	WEST BR	2.43
0375-4	Northeast River	021306080375		4.71
0374-2	Northeast River	021306080374		2.71
0374-1	Northeast River	021306080374	NORTHEAST R UT	3.29
0375-2	Northeast River	021306080375		3.29
0374-3	Northeast River	021306080374		3.57
0374-4	Northeast River	021306080374		2.14
0379-1	Northeast River	021306080379	NORTHEAST CR	2.14
0379-2	Northeast River	021306080379	NORTHEAST CR UT	1.86
0379-3	Northeast River	021306080379	NORTHEAST CR UT	3.29
0379-5	Northeast River	021306080379	NORTHEAST CR UT	4.14
0375-3	Northeast River	021306080375		4.14

Northeast River/Furnace Bay

Fish Species Present

AMERICAN EEL
BANDED KILLIFISH
BLACK CRAPPIE
BLACKNOSE DACE
BLUE RIDGE SCULPIN
BLUEGILL
BROWN BULLHEAD
COMMON SHINER
CREEK CHUB
CUTLIPS MINNOW
FATHEAD MINNOW
GOLDEN SHINER
GREEN SUNFISH
LARGEMOUTH BASS
LONGNOSE DACE
MARGINED MADTOM
NORTHERN HOGSUCKER
PUMPKINSEED
REDBREAST SUNFISH
RIVER CHUB
ROSYSIDE DACE
SATINFIN SHINER
SMALLMOUTH BASS
SPOTTAIL SHINER
SWALLOWTAIL SHINER
TESSELLATED DARTER
WHITE SUCKER

Exotic Plants Present

JAPANESE HONEYSUCKLE
MULTIFLORA ROSE
MILE-A-MINUTE
MICROSTEGIUM

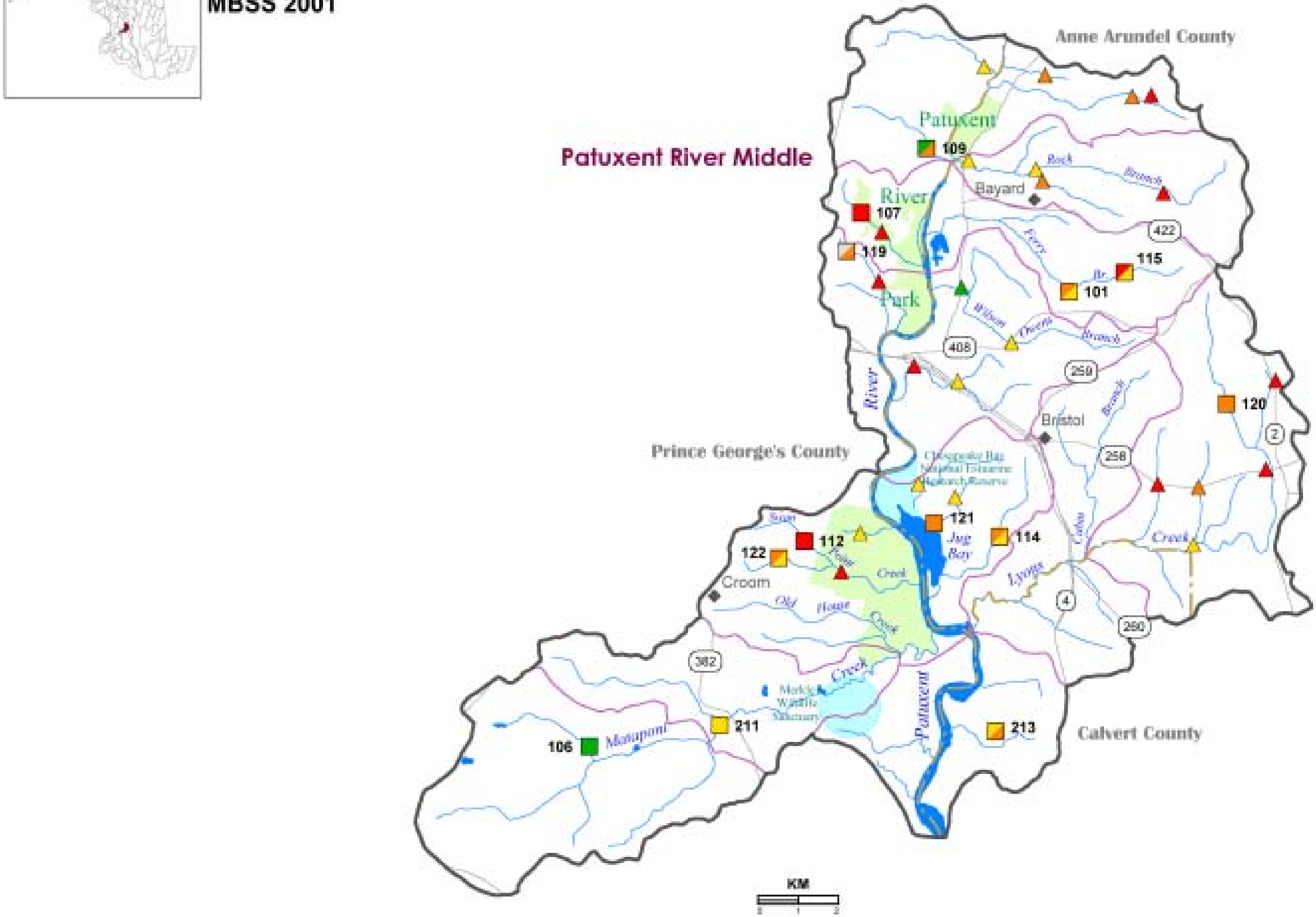
Benthic Taxa Present

ABLABESMYIA
ACERPENNA
AGABUS
ALLOCAPNIA
AMELETUS
ANCHYTARSUS
ANCYRONYX
ARGIA
ATHERIX
BAETIDAE
BOYERIA
BRILLIA
CAECIDOTEA
CAENIS
CALLIBAETIS
CALOPTERYX
CAMBARIDAE
CAPNIIDAE
CENTROPTILUM
CHELIFERA
CHEUMATOPSYCHE
CHIMARRA
CHIRONOMINAE
CLINOCERA
CONCHAPELOPIA
CORDULIIDAE
CORYNONEURA
CRICOTOPUS/ORTHOCLADIUS
CRYPTOCHIRONOMUS
CULICOIDES
CYMBIODYTA
DIAMESA
DICROTENDIPES
DINEUTUS
DIPLECTRONA
DIPLOCLADIUS
DUBIRAPHIA
DUGESIA
ENDOCHIRONOMUS
ENOCHRUS
EPEORUS
EPHEMERA
EPHEMERELLA
EUKIEFFERIELLA
EURYLOPHELLA
GAMMARUS
GONIOBASIS
GYRINUS
HABROPHLEBIA
HELICHUS
HETEROTRISSOCLADIUS
HYDROBAENUS
HYDROBIUS
HYDROPORUS
HYDROPSYCHE
HYDROPSYCHIDAE
ISONYCHIA
ISOTOMURUS
LEPTOCERIDAE
LEPTOPHLEBIA
LEPTOPHLEBIIDAE
LEUCTRA
LIMNEPHILIDAE
LIMNODRILUS
LYPE
MACRONYCHUS
MENETUS
MEROPELOPIA
MICROPSECTRA
MICROTENDIPES
NAIDIDAE
NANOCLADIUS
NEMOURIDAE
NEOPHYLAX
NYCTIOPHYLAX
OEMOPTERYX
OPTIOSERVUS
ORTHOCLADIINAE
ORTHOCLADIINAE A
ORTHOCLADIUS
PARAKIEFFERIELLA
PARALEPTOPHLEBIA
PARAMERINA
PARAMETRIOCNEMUS
PARATANYTARSUS
PARATENDIPES
PHAENOPSECTRA
PHILOPOTAMIDAE
PHYSELLA
POLYCENTROPODIDAE
POLYCENTROPUS
POLYPEDILUM
PROCLADIUS
PROSIMULIUM
PROSTOIA
PSECTROCLADIUS
PSEPHENUS
PTILOSTOMIS
PYCNOPSYCHE
RHEOCRICOTOPUS
RHEOTANYTARSUS
RHYACOPHILA
SIALIS
SPHAERIIDAE
SPHAERIUM
SPIROSPERMA
STEGOPTERNA
STENACRON
STENELMIS
STENOCHIRONOMUS
STENONEMA
STICTOCHIRONOMUS
STILOCLADIUS
STROPHOPTERYX
STYGONECTES
SYMPOSIOCLADIUS
SYMPOTTHASTIA
TANYPODINAE
TANYTARSUS
THIENEMANNIELLA
TIPULA
TIPULIDAE
TRIBELOS
TRISSOPELOPIA
TROPISTERNUS
TUBIFICIDAE
TVETENIA
XYLOTOPUS
ZAVRELIMYIA

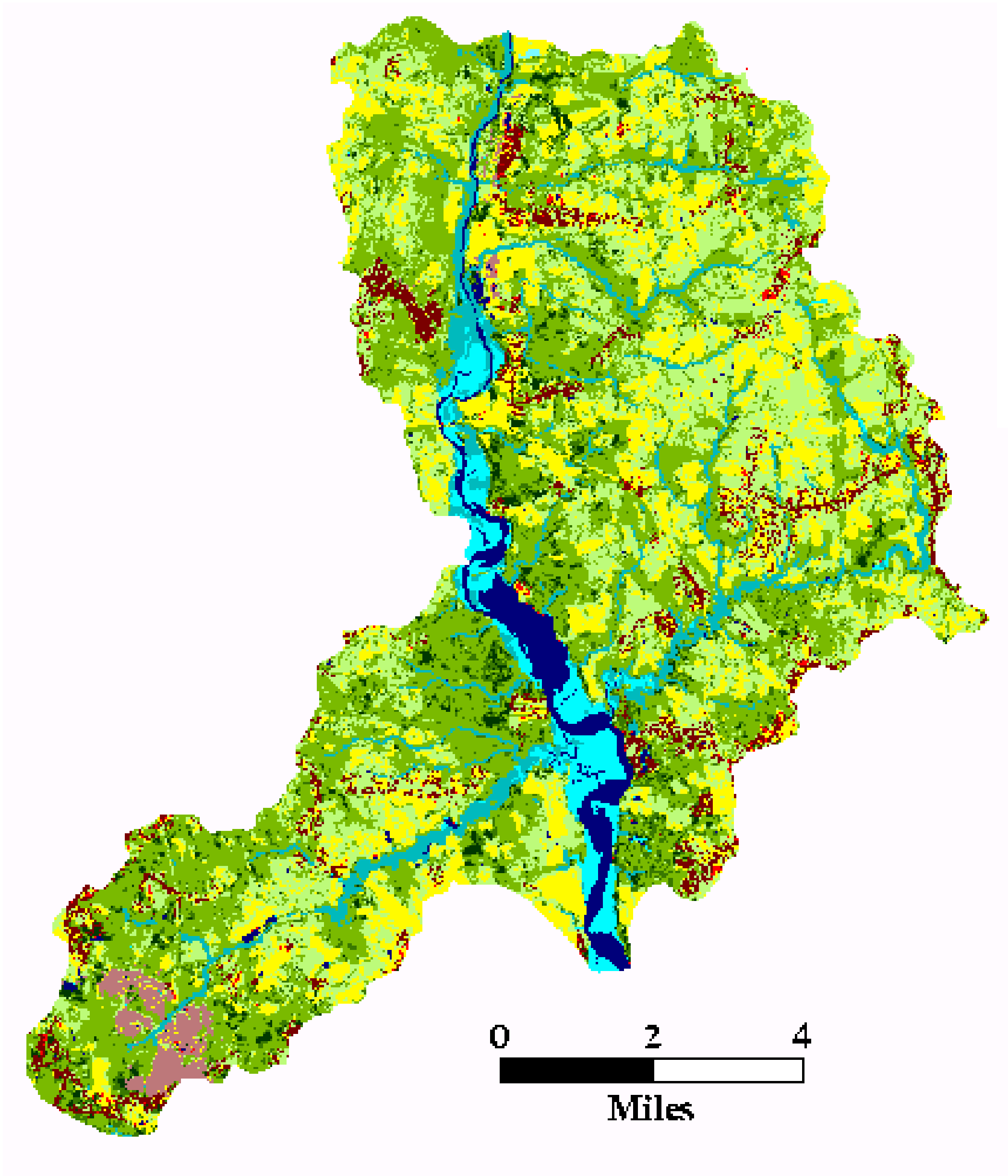
Herpetofauna Present

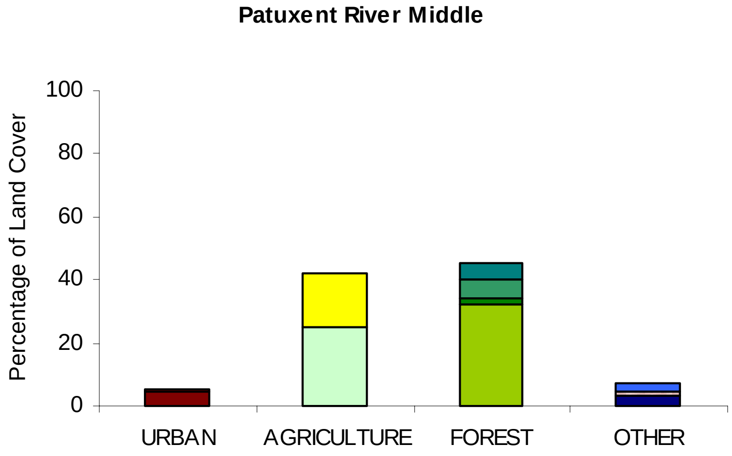
AMERICAN TOAD
BULLFROG
COMMON SNAPPING TURTLE
EASTERN BOX TURTLE
GREEN FROG
NORTHERN TWO-LINED SALAMANDER
NORTHERN WATER SNAKE
PICKEREL FROG
REDBACK SALAMANDER

Patuxent River Middle watershed
MBSS 2001



Patuxent River Middle





Patuxent River Middle

Site Information

Site	Stream Name	12-Digit Subwatershed Code	8-digit Watershed	Basin	County	Date Sampled Spring	Date Sampled Summer	Order	Catchment Area (acres)
PAXM-101-R-2001	FERRY BR	021311020915	Patuxent River (Middle)	PATUXENT RIVER	Anne Arundel	27-Mar-01	26-Jul-01	1	1628
PAXM-106-R-2001	MATAPONI CR UT1	021311020905	Patuxent River (Middle)	PATUXENT RIVER	Prince Georges	26-Mar-01	11-Jun-01	1	1393
PAXM-107-R-2001	PATUXENT R UT7	021311020915	Patuxent River (Middle)	PATUXENT RIVER	Prince Georges	27-Mar-01	5-Jun-01	1	332
PAXM-109-R-2001	DISTRICT BR	021311020917	Patuxent River (Middle)	PATUXENT RIVER	Prince Georges	27-Mar-01	23-Jul-01	1	1308
PAXM-112-R-2001	SWAN POINT CR	021311020908	Patuxent River (Middle)	PATUXENT RIVER	Prince Georges	26-Mar-01	11-Jul-01	1	334
PAXM-114-R-2001	DEEP CR	021311020908	Patuxent River (Middle)	PATUXENT RIVER	Anne Arundel	26-Mar-01	31-Jul-01	1	723
PAXM-115-R-2001	FERRY BR	021311020915	Patuxent River (Middle)	PATUXENT RIVER	Anne Arundel	27-Mar-01	26-Jul-01	1	866
PAXM-119-R-2001	PATUXENT R UT8	021311020914	Patuxent River (Middle)	PATUXENT RIVER	Prince Georges	15-Mar-01	23-Jul-01	1	139
PAXM-120-R-2001	LYONS CR	021311020910	Patuxent River (Middle)	PATUXENT RIVER	Anne Arundel	26-Mar-01	31-Jul-01	1	1372
PAXM-121-R-2001	PINDELL BR	021311020908	Patuxent River (Middle)	PATUXENT RIVER	Anne Arundel	27-Mar-01	11-Jul-01	1	433
PAXM-122-R-2001	SWAN POINT CR UT1	021311020908	Patuxent River (Middle)	PATUXENT RIVER	Prince Georges	26-Mar-01	5-Jun-01	1	335
PAXM-211-R-2001	MATAPONI CR	021311020907	Patuxent River (Middle)	PATUXENT RIVER	Prince Georges	26-Mar-01	11-Jun-01	2	6809
PAXM-213-R-2001	CABIN BR	021311020906	Patuxent River (Middle)	PATUXENT RIVER	Anne Arundel	26-Mar-01	19-Jul-01	2	2381

Indicator Information

Site	FIBI	BIBI	PHI	Brook Trout Present	Black Water Stream
PAXM-101-R-2001	2.00	3.29	62.32	0	0
PAXM-106-R-2001	4.00	4.14	86.37	0	0
PAXM-107-R-2001	1.00	1.86	50.19	0	0
PAXM-109-R-2001	4.75	2.43	62.32	0	0
PAXM-112-R-2001	1.50	1.29	34.73	0	0
PAXM-114-R-2001	2.75	3.00	36.24	0	0
PAXM-115-R-2001	1.75	3.29	46.07	0	0
PAXM-119-R-2001	NR	2.43	31.08	0	0
PAXM-120-R-2001	2.50	2.14	29.00	0	0
PAXM-121-R-2001	2.50	2.71	30.85	0	0
PAXM-122-R-2001	2.00	3.00	73.30	0	0
PAXM-211-R-2001	3.00	3.57	94.17	0	0
PAXM-213-R-2001	3.25	2.71	86.24	0	0

Catchment Land Use Information

Site	Percent Urban	Percent Agriculture	Percent Forest	Percent Other	Percent Impervious Surface
PAXM-101-R-2001	2.57	65.54	31.68	0.21	1.03
PAXM-106-R-2001	11.80	24.05	62.95	1.20	3.45
PAXM-107-R-2001	12.45	35.65	51.81	0.10	3.21
PAXM-109-R-2001	0.72	52.11	47.05	0.12	0.18
PAXM-112-R-2001	6.03	72.10	21.49	0.38	1.60
PAXM-114-R-2001	2.26	52.87	44.56	0.30	0.70
PAXM-115-R-2001	4.53	67.39	28.00	0.07	1.88
PAXM-119-R-2001	20.36	56.11	23.08	0.45	6.56
PAXM-120-R-2001	2.60	69.97	26.83	0.60	0.95
PAXM-121-R-2001	0.00	39.46	60.54	0.00	0.00
PAXM-122-R-2001	0.75	26.79	72.45	0.00	0.19
PAXM-211-R-2001	6.45	31.23	52.07	10.25	1.89
PAXM-213-R-2001	4.46	62.82	32.47	0.25	1.26

Interpretation of Watershed Condition

- Nitrogen and phosphorous levels elevated at most sites
- High turbidity at most sites
- Physical habitat parameters generally good
- Garbage in stream at many sites
- Low ANC at many sites

Patuxent River Middle

Water Chemistry Information

Site	Closed pH	Specific Cond.	ANC (µeq/L)	Cl (mg/L)	Nitrate-N (mg/L)	SO4 (mg/L)	T-P (mg/L)	Ortho-P (mg/L)	Nitrite (mg/L)	Ammonia (mg/L)	T-N (mg/L)	DOC (mg/L)	DO (mg/L)	Turbidity (mg/L)
PAXM-101-R-2001	6.72	174.3	176.4	18.938	1.726	23.849	0.0884	0.006	0.0046	0.074	2.015	1.798	6.5	27.7
PAXM-106-R-2001	6.26	145.2	81.0	21.891	0.376	19.080	0.0315	0.001	0.0019	0.026	0.497	3.383	8.2	12.3
PAXM-107-R-2001	6.15	236.3	99.6	36.628	0.883	31.139	0.0511	0.001	0.0013	0.073	0.917	1.305	9.4	7
PAXM-109-R-2001	6.92	194.0	265.9	20.637	1.145	30.566	0.0704	0.005	0.0020	0.042	1.330	1.119	9.3	15
PAXM-112-R-2001	6.46	196.1	170.7	22.376	1.410	29.031	0.1427	0.008	0.0035	0.044	1.692	2.146	7.7	40.5
PAXM-114-R-2001	6.71	199.2	145.5	28.956	0.733	25.718	0.1015	0.008	0.0030	0.049	0.951	2.300	8.2	8.7
PAXM-115-R-2001	6.65	166.6	185.5	16.191	1.849	24.552	0.0996	0.008	0.0036	0.050	2.293	1.441	6.9	26.7
PAXM-119-R-2001	6.38	271.2	91.7	37.315	1.929	40.132	0.0692	0.001	0.0004	0.088	2.142	1.183	7.5	13.8
PAXM-120-R-2001	6.79	184.3	168.5	19.319	2.041	27.896	0.0822	0.009	0.0120	0.076	2.326	2.830	8.3	14.4
PAXM-121-R-2001	5.11	61.0	-4.6	3.787	0.001	14.895	0.0110	0.001	0.0004	0.019	0.125	1.866	7.4	1
PAXM-122-R-2001	6.60	173.3	224.8	19.830	0.511	26.724	0.1040	0.033	0.0025	0.032	0.652	2.193	9.1	18.4
PAXM-211-R-2001	6.64	201.1	135.6	24.645	0.705	32.195	0.0380	0.004	0.0027	0.053	0.951	3.087	8.2	7.3
PAXM-213-R-2001	6.84	172.8	230.1	18.538	1.052	26.139	0.1097	0.008	0.0053	0.043	1.258	2.711	6.9	14

Physical Habitat Condition

Site	Riparian Buffer Width Left	Riparian Buffer Width Right	Adjacent Cover Left	Adjacent Cover Right	Instream Habitat Structure	Epifaunal Substrate	Velocity/ Depth Diversity	Pool/ Glide/ Eddy Quality	Extent of Pools (m)	Riffle/ Run Quality	Extent of Riffles (m)	Embed-dedness	Shading	Trash Rating	Maximum Depth (cm)
PAXM-101-R-2001	50	50	FR	FR	9	7	11	11	63	9	15	45	85	18	51
PAXM-106-R-2001	5	50	CP	FR	16	16	13	13	37	13	45	35	90	18	53
PAXM-107-R-2001	40	50	HO	FR	10	10	11	11	50	7	30	55	85	8	56
PAXM-109-R-2001	50	50	FR	FR	10	10	11	11	35	9	40	45	92	16	51
PAXM-112-R-2001	45	50	HO	OF	7	6	11	11	50	6	30	60	90	3	58
PAXM-114-R-2001	20	50	PV	FR	8	14	8	8	34	11	51	45	80	14	44
PAXM-115-R-2001	50	50	FR	FR	9	10	8	9	67	8	8	40	89	18	36
PAXM-119-R-2001	20	15	HO	CP	9	8	11	11	66	7	9	90	95	2	58
PAXM-120-R-2001	50	50	FR	FR	12	8	5	8	75	0	0	100	90	17	44
PAXM-121-R-2001	50	50	FR	FR	12	16	6	7	45	6	30	70	95	19	12
PAXM-122-R-2001	50	50	LN	FR	14	12	11	11	25	10	55	40	95	16	52
PAXM-211-R-2001	50	50	FR	FR	17	16	17	15	35	15	50	30	90	13	88
PAXM-213-R-2001	50	50	FR	FR	8	7	15	15	60	12	20	35	90	13	117

Patuxent River Middle

Physical Habitat Modifications

Site	Buffer Breaks?	Surface Mine?	Landfill?	Channelization?	Erosion Severity Left	Erosion Severity Right	Bar Formation
PAXM-101-R-2001	N	N	N	N	Moderate	Moderate	Severe
PAXM-106-R-2001	N	N	N	N	Moderate	Moderate	Severe
PAXM-107-R-2001	Y	N	N	N	Severe	Moderate	Moderate
PAXM-109-R-2001	N	N	N	N	Severe	Severe	Severe
PAXM-112-R-2001	N	N	N	N	Severe	Moderate	Moderate
PAXM-114-R-2001	Y	N	N	N	Moderate	Moderate	Moderate
PAXM-115-R-2001	N	N	N	N	Severe	Severe	Moderate
PAXM-119-R-2001	Y	N	N	N	Moderate	Mild	Moderate
PAXM-120-R-2001	N	N	N	Y	Mild	Mild	Minor
PAXM-121-R-2001	N	N	N	N	None	None	None
PAXM-122-R-2001	N	N	N	N	Moderate	Severe	Moderate
PAXM-211-R-2001	N	N	N	N	Moderate	Moderate	Severe
PAXM-213-R-2001	N	N	N	N	Severe	Severe	Moderate

Stream Waders Data

Site	8-Digit Watershed	12-Digit Subwatershed	Stream Name	Benthic IBI
0916-3	Patuxent River middle	021311020916	ROCK BR	3.29
0916-2	Patuxent River middle	021311020916	DEEP RUN BR	2.71
0910-5	Patuxent River middle	021311020910		1.29
0910-2	Patuxent River middle	021311020910	LYONS CR UT	2.14
0914-4	Patuxent River middle	021311020914	WILSON OWEN BR	3.57
0908-4	Patuxent River middle	021311020908	SWAN POINT CR	1.57
0908-5	Patuxent River middle	021311020908	BLACK WALNUT CR	3.29
0914-1	Patuxent River middle	021311020914	PATUXENT R UT	1.86
0915-1	Patuxent River middle	021311020915	PATUXENT R UT	1.29
0914-2	Patuxent River middle	021311020914	GALLOWAY CR	1.86
0908-1	Patuxent River middle	021311020908	TWO RUN BR	3.57
0908-2	Patuxent River middle	021311020908	PINDELL BR	3.86
0914-3	Patuxent River middle	021311020914	GALLOWAY CR	3.29
0914-5	Patuxent River middle	021311020914	WILSON OWEN BR	4.14
0916-1	Patuxent River middle	021311020916	ROCK BR	3.86
0917-1	Patuxent River middle	021311020917		3.86
0910-4	Patuxent River middle	021311020910	LYONS CR	1.86
0908-3	Patuxent River middle	021311020908	DEEP CR BR	1.86
0910-1	Patuxent River middle	021311020910	LYONS CR UT	1.29
0917-4	Patuxent River middle	021311020917		2.43
0910-3	Patuxent River middle	021311020910	LYONS CR	3.00
0917-2	Patuxent River middle	021311020917		2.71
0916-4	Patuxent River middle	021311020916	ROCK BR	1.57
0917-3	Patuxent River middle	021311020917		1.57

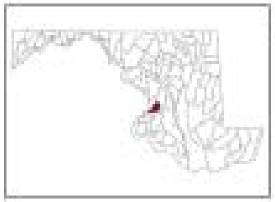
Patuxent River Middle

Fish Species Present
AMERICAN BROOK LAMPREY
AMERICAN EEL
BLACKNOSE DACE
BLUEGILL
BLUESPOTTED SUNFISH
CREEK CHUBSUCKER
EASTERN MUDMINNOW
FALLFISH
GOLDEN SHINER
GREEN SUNFISH
LEAST BROOK LAMPREY
PIRATE PERCH
PUMPKINSEED
REDFIN PICKEREL
ROSYSIDE DACE
SATINFIN SHINER
SWALLOWTAIL SHINER
TADPOLE MADTOM
TESSELLATED DARTER
WHITE SUCKER

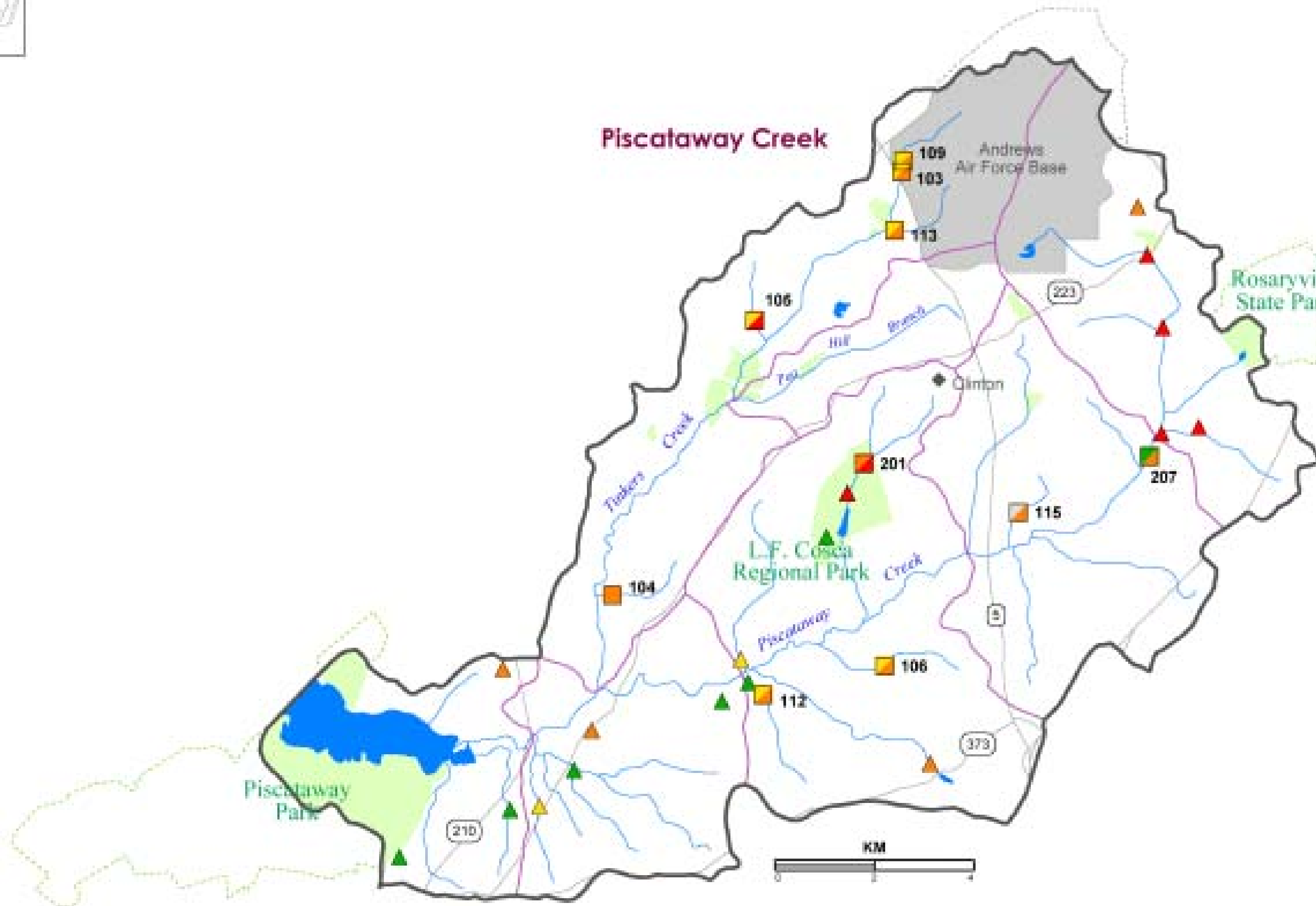
Exotic Plants Present
JAPANESE HONEYSUCKLE
MULTIFLORA ROSE
MILE-A-MINUTE
MICROSTEGIUM

Herpetofauna Present
AMERICAN TOAD
BULLFROG
EASTERN WORM SNAKE
FOWLER'S TOAD
GREEN FROG
NORTHERN TWO-LINED SALAMANDER
SOUTHERN LEOPARD FROG
WOOD FROG

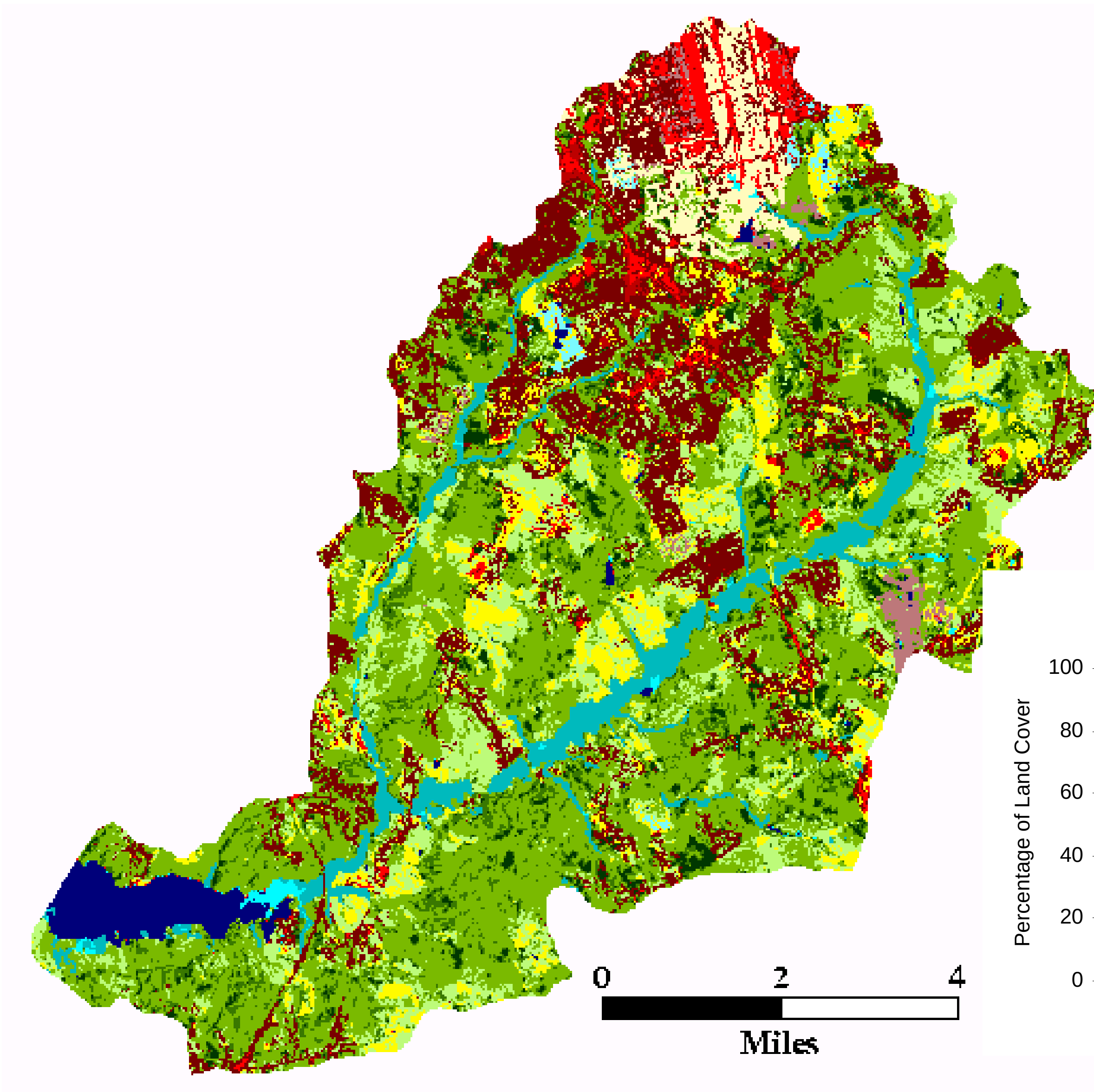
Benthic Taxa Present
ABLABESMYIA
ACERPENNA
ALLOCAPNIA
AMELETUS
AMPHINEMURA
ANCYRONYX
ANTOCHA
BITTACOMORPHA
BOYERIA
BRACONIDAE
BRILLIA
CAECIDOTEA
CALOPTERYX
CAPNIDAE
CHAETOCLADIUS
CHELIFERA
CHEUMATOPSYCHE
CHIRONOMIDAE
CHIRONOMINI
CHLOROPERLIDAE
CHRYSOPS
CLINOCERA
CLIOPERLA
CONCHAPELOPIA
CORDULEGASTER
CORYNONEURA
CRANGONYCTIDAE
CRANGONYX
CRICOTOPUS
CRICOTOPUS/ORTHOCLADIUS
CURCULIONIDAE
DICRANOTA
DIPLECTRONA
DIPLOCLADIUS
DUBIRAPHIA
DYTISCIDAE
ECCOPTURA
ENCHYTRAEIDAE
EPHEMERELLA
EUKIEFFERIELLA
GAMMARUS
GORDIIDAE
HEMERODROMIA
HETEROTRISSOCLADIUS
HEXATOMA
HIRUDINEA
HYALELLA
HYDROBIUS
HYDROPORUS
HYDROPSYCHE
IRONOQUIA
ISOPERLA
LEPTOPHLEBIA
LEUCTRA
LEUCTRIDAE
LIMNEPHILIDAE
LIMNODRILUS
LIMNOPHILA
LUMBRICULIDAE
LYPE
MEROPELOPIA
MICROPSECTRA
MICROTENDIPES
NAIDIDAE
NEMOURIDAE
NEOPHYLAX
NIGRONIA
ORTHOCLADIINAE
ORTHOCLADIINAE A
OULIMNIUS
PARACAPNIA
PARACLADOPELMA
PARAMETRIOCNEMUS
PARATANYTARSUS
PERLODIDAE
PHAENOPSECTRA
POLYCENTROPUS
POLYPEDILUM
PRODIAMESA
PROSIMULIUM
PROSTOIA
PSEUDOLIMNOPHILA
PYCNOPSYCHE
RHEOCRICOTOPUS
RHEOTANYTARSUS
RHYACOPHILA
SIMULIIDAE
SIMULIUM
SPHAERIIDAE
SPHAERIUM
SPIROSPERMA
STEGOPTERNA
STEMPELLINELLA
STENONEMA
STROPHOPTERYX
STYGONECTES
SYMPOSIOCLADIUS
SYNURELLA
TANYPODINAE
TANYTARSINI
TANYTARSUS
THIENEMANNIELLA
THIENEMANNIMYIA GROUP
TIPULA
TIPULIDAE
TRIAENODES
TRIBELOS
TRISSOPELOPIA
TUBIFICIDAE
TVETENIA
WORMALDIA
ZAVRELIMYIA

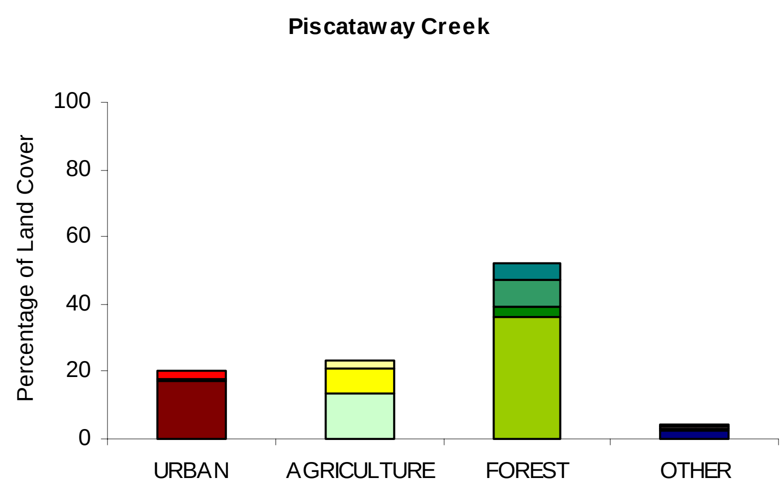


Piscataway Creek watershed
MBSS 2001



Piscataway Creek





Piscataway Creek

Site Information

Site	Stream Name	12-Digit Subwatershed Code	8-digit Watershed	Basin	County	Date Sampled Spring	Date Sampled Summer	Order	Catchment Area (acres)
PISC-103-R-2001	MEETINGHOUSE BR	021402030800	Piscataway CR	WASHINGTON METROPOLITAN	Prince Georges	20-Mar-01	26-Jun-01	1	789
PISC-104-R-2001	TINKERS CR UT2	021402030800	Piscataway CR	WASHINGTON METROPOLITAN	Prince Georges	15-Mar-01	3-Jul-01	1	445
PISC-105-R-2001	TINKERS CR UT1	021402030800	Piscataway CR	WASHINGTON METROPOLITAN	Prince Georges	19-Mar-01	19-Jul-01	1	412
PISC-106-R-2001	PISCATAWAY UT3	021402030801	Piscataway CR	WASHINGTON METROPOLITAN	Prince Georges	14-Mar-01	28-Jun-01	1	592
PISC-109-R-2001	MEETINGHOUSE BR	021402030800	Piscataway CR	WASHINGTON METROPOLITAN	Prince Georges	20-Mar-01	26-Jun-01	1	684
PISC-112-R-2001	BURCH CR UT1	021402030801	Piscataway CR	WASHINGTON METROPOLITAN	Prince Georges	14-Mar-01	28-Jun-01	1	582
PISC-113-R-2001	PAYNES BR	021402030800	Piscataway CR	WASHINGTON METROPOLITAN	Prince Georges	19-Mar-01	26-Jun-01	1	734
PISC-115-R-2001	PISCATAWAY CR UT1	021402030803	Piscataway CR	WASHINGTON METROPOLITAN	Prince Georges	14-Mar-01	3-Jul-01	1	272
PISC-201-R-2001	BUTLER BR	021402030801	Piscataway CR	WASHINGTON METROPOLITAN	Prince Georges	15-Mar-01	12-Jul-01	2	874
PISC-207-R-2001	PISCATAWAY CR	021402030803	Piscataway CR	WASHINGTON METROPOLITAN	Prince Georges	14-Mar-01	12-Jul-01	2	6786

Indicator Information

Site	FIBI	BIBI	PHI	Brook Trout Present	Black Water Stream
PISC-103-R-2001	3.25	2.14	75.80	0	0
PISC-104-R-2001	2.00	2.71	58.90	0	0
PISC-105-R-2001	3.00	1.57	27.88	0	0
PISC-106-R-2001	3.00	2.71	38.04	0	0
PISC-109-R-2001	3.50	2.71	61.54	0	0
PISC-112-R-2001	3.50	2.43	73.94	0	0
PISC-113-R-2001	3.50	2.43	90.60	0	0
PISC-115-R-2001	NR	2.14	6.55	0	0
PISC-201-R-2001	2.50	1.57	51.02	0	0
PISC-207-R-2001	4.25	2.43	92.62	0	0

Catchment Land Use Information

Site	Percent Urban	Percent Agriculture	Percent Forest	Percent Other	Percent Impervious Surface
PISC-103-R-2001	65.36	18.08	11.83	4.73	24.10
PISC-104-R-2001	14.72	18.26	66.81	0.21	3.86
PISC-105-R-2001	33.51	3.36	62.90	0.23	8.49
PISC-106-R-2001	17.31	16.20	66.44	0.05	4.49
PISC-109-R-2001	70.10	16.47	11.12	2.31	26.02
PISC-112-R-2001	11.51	9.73	78.49	0.27	3.09
PISC-113-R-2001	40.82	35.46	21.78	1.93	13.59
PISC-115-R-2001	20.85	8.53	70.62	0.00	7.75
PISC-201-R-2001	47.10	16.66	35.08	1.15	12.46
PISC-207-R-2001	22.56	31.45	42.38	3.60	8.79

Interpretation of Watershed Condition

- Several sites located in highly urbanized catchments
- Chlorine and phosphorus levels elevated at many sites
- Several sites with high turbidity
- Bar formation severe throughout watershed
- Physical habitat parameters generally good
- Sewage smell observed at sites 105 and 109

Piscataway Creek

Water Chemistry Information

Site	Closed pH	Specific Cond.	ANC (μeq/L)	Cl (mg/L)	Nitrate-N (mg/L)	SO4 (mg/L)	T-P (mg/L)	Ortho-P (mg/L)	Nitrite (mg/L)	Ammonia (mg/L)	T-N (mg/L)	DOC (mg/L)	DO (mg/L)	Turbidity (mg/L)
PISC-103-R-2001	7.21	557.5	766.1	110.906	0.905	22.110	0.0172	0.001	0.0089	0.038	1.129	3.615	6.7	8.1
PISC-104-R-2001	7.95	260.8	466.6	37.463	0.473	28.997	0.0236	0.008	0.0020	0.004	0.540	1.467	9.5	1.2
PISC-105-R-2001	6.39	256.0	517.6	36.176	0.435	19.276	0.1665	0.013	0.0293	2.212	2.988	4.748	3.6	4.9
PISC-106-R-2001	6.61	126.7	197.8	14.184	0.406	18.061	0.0521	0.004	0.0004	0.074	0.515	1.812	6	16.6
PISC-109-R-2001	7.19	414.3	700.2	70.975	1.124	22.365	0.0234	0.001	0.0082	0.017	1.275	2.951	6.5	3.2
PISC-112-R-2001	6.51	104.7	75.1	12.629	0.258	16.615	0.0548	0.003	0.0011	0.023	0.262	1.550	7.8	12.6
PISC-113-R-2001	6.91	337.8	441.3	59.755	0.945	19.798	0.0141	0.001	0.0041	0.031	1.266	3.111	6.1	3.8
PISC-115-R-2001	5.99	170.8	67.0	26.255	0.277	26.485	0.0357	0.001	0.0023	0.031	0.289	1.570	7.7	4.8
PISC-201-R-2001	6.83	238.4	299.9	36.665	0.936	20.829	0.0528	0.001	0.0007	0.040	1.186	2.230	7.4	12
PISC-207-R-2001	7.05	268.7	356.7	47.059	0.471	19.326	0.0402	0.002	0.0038	0.016	0.659	4.123	6.5	10.4

Physical Habitat Condition

Site	Riparian Buffer Width Left	Riparian Buffer Width Right	Adjacent Cover Left	Adjacent Cover Right	Instream Habitat Structure	Epifaunal Substrate	Velocity/ Depth Diversity	Pool/ Glide/ Eddy Quality	Extent of Pools (m)	Riffle/Run Quality	Extent of Riffles (m)	Embedded-ness	Shading	Trash Rating	Maximum Depth (cm)
PISC-103-R-2001	45	50	PV	FR	13	10	12	12	52	10	33	20	85	9	69
PISC-104-R-2001	40	50	PA	FR	16	18	9	10	28	13	50	17	86	6	30
PISC-105-R-2001	50	50	FR	FR	9	3	7	8	63	6	13	15	75	1	44
PISC-106-R-2001	50	50	FR	FR	12	15	8	9	60	8	21	40	88	5	41
PISC-109-R-2001	48	50	GR	FR	10	11	11	12	57	7	22	35	79	9	63
PISC-112-R-2001	50	50	OF	FR	13	17	12	11	48	10	31	25	90	12	60
PISC-113-R-2001	50	40	FR	HO	14	12	15	14	40	11	40	16	70	12	92
PISC-115-R-2001	40	50	PK	FR	3	2	3	4	70	2	7	75	90	14	24
PISC-201-R-2001	50	50	FR	FR	7	11	11	11	15	7	65	40	95	10	64
PISC-207-R-2001	40	50	DI	FR	12	11	12	16	70	16	5	30	75	14	150

Physical Habitat Modifications

Site	Buffer Breaks?	Surface Mine?	Landfill?	Channelization?	Erosion Severity Left	Erosion Severity Right	Bar Formation
PISC-103-R-2001	N	N	N	N	Moderate	Moderate	Severe
PISC-104-R-2001	N	N	N	N	Severe	Moderate	Severe
PISC-105-R-2001	N	N	N	N	Moderate	Mild	Severe
PISC-106-R-2001	N	N	N	N	Severe	Severe	Severe
PISC-109-R-2001	N	N	N	N	Moderate	Moderate	Severe
PISC-112-R-2001	N	N	N	N	Moderate	Moderate	Severe
PISC-113-R-2001	Y	N	N	N	Moderate	Mild	Severe
PISC-115-R-2001	Y	N	N	N	Severe	Severe	Severe
PISC-201-R-2001	N	N	N	N	Moderate	Severe	Severe
PISC-207-R-2001	N	N	N	N	Moderate	Moderate	Moderate

Piscataway Creek

Stream Waders Data

Site	8-Digit Watershed	12-Digit Subwatershed	Stream Name	Benthic IBI
0799-5	Piscataway Creek	021402030799		4.43
0801-5	Piscataway Creek	021402030801	BUTLERS BR	1.57
0804-5	Piscataway Creek	021402030804	PISCATAWAY CR	1.86
0804-3	Piscataway Creek	021402030804	PISCATAWAY CR UT	1.57
0801-4	Piscataway Creek	021402030801	UT	4.43
0801-2	Piscataway Creek	021402030801	PISCATAWAY CR UT	4.71
0801-5	Piscataway Creek	021402030801	BUTLERS BR	1.57
0804-4	Piscataway Creek	021402030804	PISCATAWAY CR UT	1.86
0804-2	Piscataway Creek	021402030804	PISCATAWAY CR UT	2.71
0799-2	Piscataway Creek	021402030799		2.71
0804-1	Piscataway Creek	021402030804	PISCATAWAY CR	1.57
0801-1	Piscataway Creek	021402030801	BURCH BR	2.14
0799-3	Piscataway Creek	021402030799		5.00
0799-4	Piscataway Creek	021402030799	PISCATAWAY CR UT	3.57
0801-3	Piscataway Creek	021402030801	PISCATAWAY CR UT	3.57
0798-1	Piscataway Creek	021402030798		4.43
0798-3	Piscataway Creek	021402030798	PISCATAWAY CR UT	2.71
0798-2	Piscataway Creek	021402030798		4.43

Piscataway Creek

Fish Species Present

AMERICAN EEL
BLACKNOSE DACE
COMMON SHINER
CREEK CHUB
CREEK CHUBSUCKER
EASTERN MUDMINNOW
GOLDEN SHINER
GREEN SUNFISH
LONGNOSE DACE
PUMPKINSEED
REDBREAST SUNFISH
ROSYSIDE DACE
TESSELLATED DARTER
WHITE SUCKER
BLUEGILL
AMERICAN EEL
SWALLOWTAIL SHINER
LEAST BROOK LAMPREY
CHAIN PICKEREL
COMELY SHINER
FALLFISH
MARGINED MADTOM
PIRATE PERCH
SATINFIN SHINER
SEA LAMPREY
TADPOLE MADTOM
YELLOW BULLHEAD

Exotic Plants Present

ENGLISH IVY
JAPANESE HONEYSUCKLE
MULTIFLORA ROSE
MILE-A-MINUTE
MICROSTEGIUM

Benthic Taxa Present

LUMBRICULIDAE
NAIDIDAE
TUBIFICIDAE
PHYSELLA
SPHAERIIDAE
ISOTOMURUS
ARGIA
CHEUMATOPSYCHE
TANYTARSINI
DIAMESINAE
CRICOTOPUS
CRICOTOPUS/ORTHOCLADIUS
NANOCLADIUS
RHEOCRICOTOPUS
CONCHAPELOPIA
PROSTOMA
LUMBRICULIDAE
CRANGONYX
AMELETUS
PROSTOIA
CLIOPERLA
CHEUMATOPSYCHE
DUBIRAPHIA
MICROTENDIPES
PARATANYTARSUS
RHEOTANYTARSUS
DIAMESA
CRICOTOPUS/ORTHOCLADIUS
ORTHOCLADIINAE A
PARAMETRIOCNEMUS
CONCHAPELOPIA
CLINOCERA
STEGOPTERNA
DICRANOTA
TIPULA
TUBIFICIDAE
LIMNEPHILIDAE
CERATOPOGONIDAE
PHAENOPSECTRA
POLYPEDILUM
TRIBELOS
PRODIAMESA
DIPLOCLADIUS
PSECTROCLADIUS
KRENOPELOPIA
TIPULA
EURYLOPHELLA
ACERPENNA
CAPNIIDAE
AMPHINEMURA
PROSTOIA
PERLODIDAE
NEOPHYLAX
OULIMNIUS
PROBEZZIA
RHEOTANYTARSUS
ORTHOCLADIINAE
CRICOTOPUS/ORTHOCLADIUS
EUKIEFFERIELLA
NANOCLADIUS
PARAMETRIOCNEMUS
TVETENIA
HEMERODROMIA
HEXATOMA
NAIDIDAE
TUBIFICIDAE
STAGNICOLA
SPHAERIIDAE
ISOTOMURUS
CALOPTERYX
ARGIA
CHEUMATOPSYCHE
HYDROPSYCHE
DICROTENDIPES
PHAENOPSECTRA
TANYTARSUS
CRICOTOPUS
CRICOTOPUS/ORTHOCLADIUS
RHEOCRICOTOPUS
ABLABESMYIA
CONCHAPELOPIA
PROSTOMA
ACERPENNA
AMPHINEMURA
PROSTOIA
HYDROPSYCHE
LIMNEPHILIDAE
NEOPHYLAX
RHEOTANYTARSUS
DIAMESINAE
CORYNONEURA
CRICOTOPUS/ORTHOCLADIUS
EUKIEFFERIELLA
ORTHOCLADIINAE A
PARAKIEFFERIELLA
PARAMETRIOCNEMUS
ABLABESMYIA
CLINOCERA
HEMERODROMIA
PROSIMULIUM
STEGOPTERNA
TUBIFICIDAE
PISCICOLA
CALOPTERYX
ENALLAGMA
CHEUMATOPSYCHE
HYDROPSYCHE
OULIMNIUS
CRYPTOCHIRONOMUS
PHAENOPSECTRA
POLYPEDILUM
TRIBELOS
MICROPSECTRA
PARATANYTARSUS
CRICOTOPUS/ORTHOCLADIUS
EUKIEFFERIELLA
ORTHOCLADIINAE A
PARAMETRIOCNEMUS
RHEOCRICOTOPUS
ABLABESMYIA
MEROPELOPIA
TRISSOPELOPIA
HEMERODROMIA
NAIDIDAE
TUBIFICIDAE
CALOPTERYX
CHEUMATOPSYCHE
HYDROPSYCHE
OPTIOSERVUS
STENELMIS
POLYPEDILUM
RHEOTANYTARSUS
TANYTARSUS
CRICOTOPUS/ORTHOCLADIUS
EUKIEFFERIELLA
RHEOCRICOTOPUS
CONCHAPELOPIA
GORDIIDAE
LUMBRICULIDAE
SYNURELLA
CAECIDOTEA
COLLEMBOLA
EPHEMERELLA
AMPHINEMURA
LIMNEPHILIDAE
NEOPHYLAX
CRICOTOPUS/ORTHOCLADIUS
PARAMETRIOCNEMUS
CONCHAPELOPIA
ZAVRELIMYIA

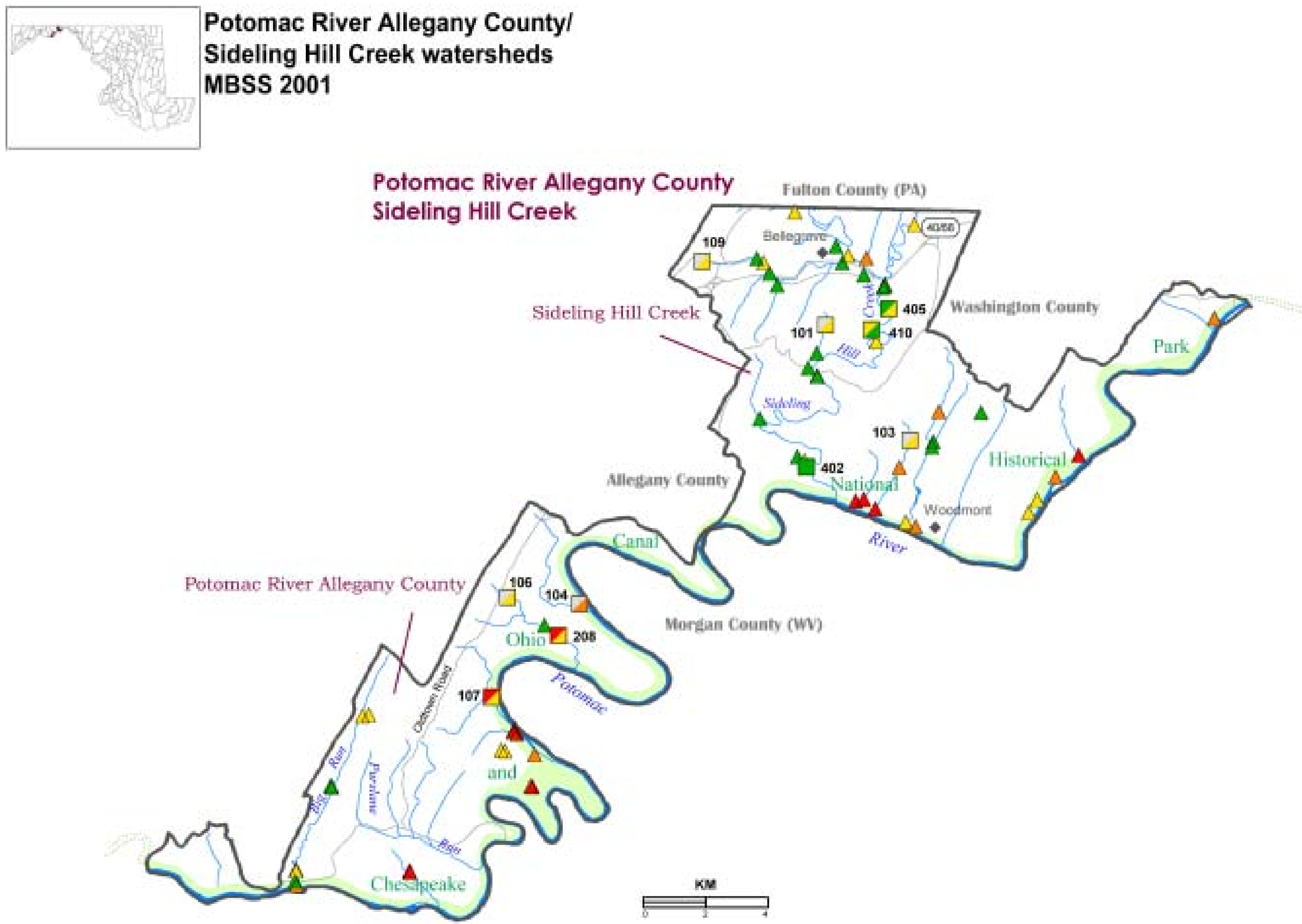
Piscataway Creek

HEMERODROMIA
PROSIMULIUM
STEGOPTERNA
GORDIIDAE
LUMBRICULIDAE
TUBIFICIDAE
DIPLECTRONA
AGABUS
CRYPTOCHIRONOMUS
TRIBELOS
TANYTARSINI
DIAMESA
ORTHOCLADIINAE
BRILLIA
CRICOTOPUS/ORTHOCLADIUS
DIPLOCLADIUS
EUKIEFFERIELLA
LIMNOPHYES
ORTHOCLADIINAE A
CONCHAPELOPIA
MEROPELOPIA
EMPIDIDAE
STEGOPTERNA
ANTOCHA
TIPULA
ACERPENNA
CHEUMATOPSYCHE
CHIMARRA
ANCYRONYX
DUBIRAPHIA
STENELMIS
DICROTENDIPES
MICROTENDIPES
PARATENDIPES
TRIBELOS
RHEOTANYTARSUS
ORTHOCLADIINAE
CRICOTOPUS
CRICOTOPUS/ORTHOCLADIUS
ORTHOCLADIINAE A
PARAMETRIOCNEMUS
RHEOCRICOTOPUS
THIENEMANNIELLA
MEROPELOPIA
STEGOPTERNA

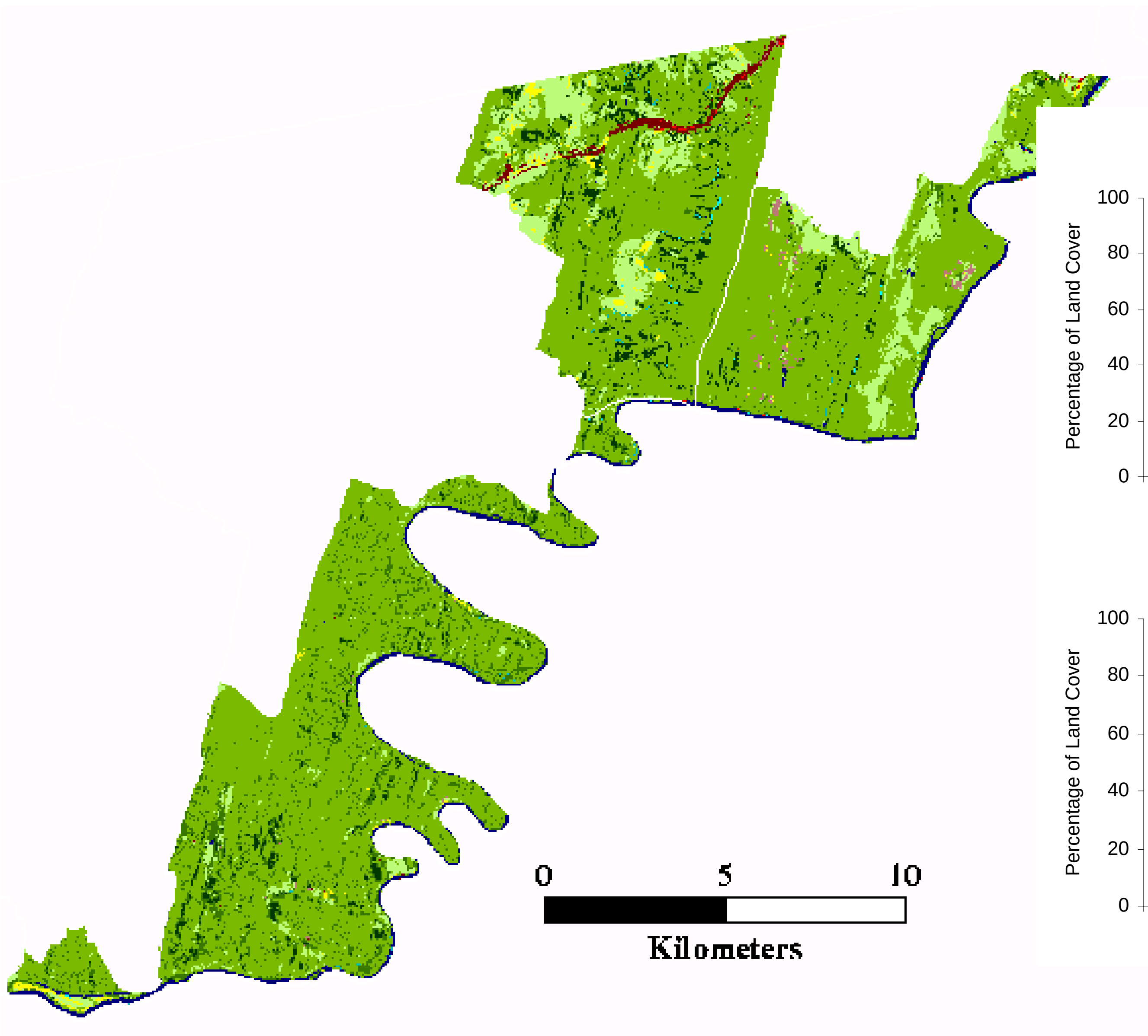
AMERICAN TOAD
BLACK RAT SNAKE
BULLFROG
COMMON SNAPPING TURTLE
EASTERN BOX TURTLE
FOWLER'S TOAD
GRAY TREEFROG
GREEN FROG
NORTHERN SPRING PEEPER
NORTHERN TWO-LINED SALAMANDER
PICKEREL FROG
SOUTHERN LEOPARD FROG
WOOD FROG

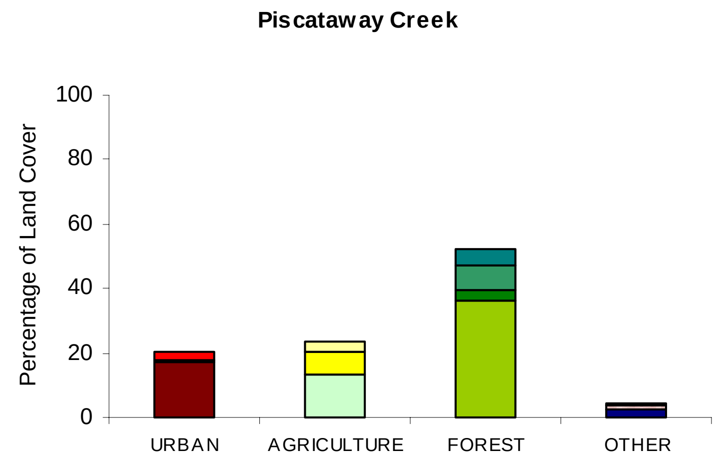
Herpetofauna Present

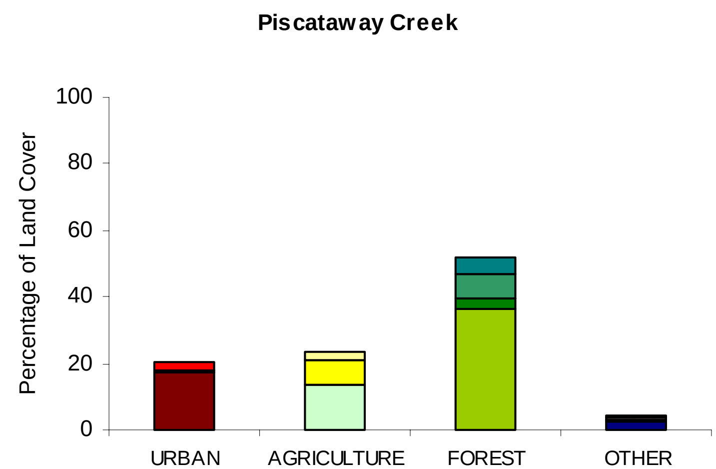
Potomac River Allegany County/ Sideling Hill Creek watersheds MBSS 2001



Potomac R Allegany County/Sideling Hill Creek







Potomac R Allegany County/Sideling Hill Creek

Site Information

Site	Stream Name	12-Digit Subwatershed Code	8-digit Watershed	Basin	County	Date Sampled Spring	Date Sampled Summer	Order	Catchment Area (acres)
PRAL-103-R-2001	POTOMAC R UT11	021405080118	Potomac River (Allegany County)	UPPER POTOMAC RIVER	Washington	27-Mar-01	30-Jul-01	1	157
PRAL-104-R-2001	DEVILS ALLEY	021405080115	Potomac River (Allegany County)	UPPER POTOMAC RIVER	Allegany	27-Mar-01	27-Jun-01	1	1467
PRAL-106-R-2001	ROBY HOLLOW UT1	021405080114	Potomac River (Allegany County)	UPPER POTOMAC RIVER	Allegany	27-Mar-01	27-Jun-01	1	115
PRAL-107-R-2001	TWIGG HOLLOW	021405080113	Potomac River (Allegany County)	UPPER POTOMAC RIVER	Allegany	27-Mar-01	27-Jun-01	1	719
PRAL-208-R-2001	ROBY HOLLOW	021405080114	Potomac River (Allegany County)	UPPER POTOMAC RIVER	Allegany	27-Mar-01	27-Jun-01	2	896
SIDE-101-R-2001	SWAIN HOLLOW	021405100149	Sideling Hill CR	UPPER POTOMAC RIVER	Allegany	26-Mar-01	27-Jun-01	1	82
SIDE-109-R-2001	SIDELING HILL CR UT2 UT1	021405100150	Sideling Hill CR	UPPER POTOMAC RIVER	Allegany	26-Mar-01	27-Jun-01	1	34
SIDE-402-R-2001	SIDELING HILL CR	021405100148	Sideling Hill CR	UPPER POTOMAC RIVER	Allegany	27-Mar-01	31-Jul-01	4	66176
SIDE-405-R-2001	SIDELING HILL CR	021405100149	Sideling Hill CR	UPPER POTOMAC RIVER	Washington	26-Mar-01	30-Jul-01	4	60029
SIDE-410-R-2001	SIDELING HILL CR	021405100149	Sideling Hill CR	UPPER POTOMAC RIVER	Washington	27-Mar-01	30-Jul-01	4	60640

Indicator Information

Site	FIBI	BIBI	PHI	Brook Trout Present	Black Water Stream
PRAL-103-R-2001	NS	3.00	NS	NS	NS
PRAL-104-R-2001	NS	2.56	NS	NS	NS
PRAL-106-R-2001	NS	3.44	NS	NS	NS
PRAL-107-R-2001	1.00	3.89	35.91	0	0
PRAL-208-R-2001	1.29	3.44	17.05	0	0
SIDE-101-R-2001	NS	3.00	NS	NS	NS
SIDE-109-R-2001	NR	3.44	17.05	0	0
SIDE-402-R-2001	4.43	4.11	82.48	0	0
SIDE-405-R-2001	4.14	3.22	83.35	0	0
SIDE-410-R-2001	3.86	4.33	28.35	0	0

Catchment Land Use Information

Site	Percent Urban	Percent Agriculture	Percent Forest	Percent Other	Percent Impervious Surface
PRAL-103-R-2001	0.00	0.00	100.00	0.00	0.00
PRAL-104-R-2001	0.00	0.36	99.64	0.00	0.00
PRAL-106-R-2001	0.00	0.00	100.00	0.00	0.00
PRAL-107-R-2001	0.00	1.01	98.91	0.09	0.00
PRAL-208-R-2001	0.04	0.53	99.40	0.04	0.01
SIDE-101-R-2001	0.00	1.52	98.48	0.00	0.00
SIDE-109-R-2001	0.00	5.77	94.23	0.00	0.00
SIDE-402-R-2001	0.53	21.90	76.32	1.25	0.15
SIDE-405-R-2001	0.58	23.25	74.83	1.34	0.16
SIDE-410-R-2001	0.58	23.05	75.04	1.33	0.16

Interpretation of Watershed Condition

- ANC values low at all sites
- Water chemistry and physical habitat parameters generally good
- Streams generally nice at all sites, tend to be remote

Potomac R Allegany County/Sideling Hill Creek

Water Chemistry Information

Site	Closed pH	Specific Cond.	ANC (µeq/L)	Cl (mg/L)	Nitrate-N (mg/L)	SO4 (mg/L)	T-P (mg/L)	Ortho-P (mg/L)	Nitrite (mg/L)	Ammonia (mg/L)	T-N (mg/L)	DOC (mg/L)	DO (mg/L)	Turbidity (mg/L)
PRAL-103-R-2001	6.43	62.8	51.7	1.582	1.010	10.993	0.0037	0.001	0.0005	0.002	1.153	1.792	NS	NS
PRAL-104-R-2001	7.27	75.5	253.2	1.145	0.207	14.377	0.0037	0.001	0.0004	0.002	0.283	1.844	NS	NS
PRAL-106-R-2001	6.77	63.2	120.7	1.375	0.371	14.279	0.0058	0.001	0.0009	0.002	0.391	1.879	NS	NS
PRAL-107-R-2001	7.08	64.6	132.3	1.411	0.898	12.566	0.0051	0.001	0.0004	0.002	1.057	1.607	8.7	2.3
PRAL-208-R-2001	6.73	62.8	158.4	1.192	0.293	13.109	0.0059	0.001	0.0006	0.002	0.292	1.840	8.6	3.2
SIDE-101-R-2001	7.23	78.9	385.9	2.448	0.001	10.768	0.0056	0.001	0.0004	0.002	0.125	1.702	NS	NS
SIDE-109-R-2001	7.46	273.0	429.3	47.330	1.351	14.993	0.0108	0.001	0.0008	0.002	1.451	1.830	7.5	6.4
SIDE-402-R-2001	7.24	86.4	162.8	7.841	0.621	11.173	0.0072	0.001	0.0013	0.002	0.691	1.589	8.7	3.6
SIDE-405-R-2001	6.98	87.4	157.2	8.038	0.670	11.072	0.0078	0.001	0.0012	0.002	0.716	1.534	7.8	3.3
SIDE-410-R-2001	6.70	88.3	163.3	8.220	0.641	11.201	0.0067	0.001	0.0011	0.002	0.725	1.390	7.7	2.6

Physical Habitat Condition

Site	Riparian Buffer Width Left	Riparian Buffer Width Right	Adjacent Cover Left	Adjacent Cover Right	Instream Habitat Structure	Epifaunal Substrate	Velocity/ Depth Diversity	Pool/ Glide/ Eddy Quality	Extent of Pools (m)	Riffle/ Run Quality	Extent of Riffles (m)	Embed-dedness	Shading	Trash Rating	Maximum Depth (cm)
PRAL-103-R-2001	50	50	FR	FR	NS	NS	NS	NS	NS	NS	NS	NS	NS	20	NS
PRAL-104-R-2001	50	50	FR	FR	NS	NS	NS	NS	NS	NS	NS	NS	NS	19	NS
PRAL-106-R-2001	50	50	FR	FR	NS	NS	NS	NS	NS	NS	NS	NS	NS	19	NS
PRAL-107-R-2001	50	50	FR	FR	13	14	7	12	50	6	25	15	92	17	52
PRAL-208-R-2001	50	7	FR	GR	8	16	7	7	40	8	45	10	95	18	22
SIDE-101-R-2001	12	50	GR	FR	NS	NS	NS	NS	NS	NS	NS	NS	NS	15	NS
SIDE-109-R-2001	50	42	FR	PV	10	11	5	2	35	6	55	40	95	15	10
SIDE-402-R-2001	50	50	FR	FR	17	16	14	15	65	15	18	15	25	18	47
SIDE-405-R-2001	50	50	FR	FR	19	19	15	20	48	13	30	20	40	18	123
SIDE-410-R-2001	50	50	FR	FR	19	16	10	19	75	0	0	20	15	19	93

Physical Habitat Modifications

Site	Buffer Breaks?	Surface Mine?	Landfill?	Channelization?	Erosion Severity Left	Erosion Severity Right	Bar Formation
PRAL-103-R-2001	N	N	N	N	NS	NS	NS
PRAL-104-R-2001	N	N	N	N	NS	NS	NS
PRAL-106-R-2001	N	N	N	N	NS	NS	NS
PRAL-107-R-2001	N	N	N	N	Mild	None	Minor
PRAL-208-R-2001	N	N	N	N	Mild	None	Minor
SIDE-101-R-2001	Y	N	N	N	NS	NS	NS
SIDE-109-R-2001	N	N	N	N	Moderate	Moderate	Minor
SIDE-402-R-2001	N	N	N	N	None	Moderate	Minor
SIDE-405-R-2001	N	N	N	N	None	None	Moderate
SIDE-410-R-2001	N	N	N	N	None	None	Minor

Potomac R Allegany County/Sideling Hill Creek

Stream Waders Data

Site	8-Digit Watershed	12-Digit Subwatershed	Stream name	Benthic IBI
0118-3	Potomac River AL Cnty	021405080118	POTOMAC R UT	1.29
0110-92	Potomac River AL Cnty	021405080110	BIG RUN	3.00
0121-5	Potomac River AL Cnty	021405080121	POTOMAC R UT	2.43
0121-4	Potomac River AL Cnty	021405080121	POTOMAC R UT	1.57
0121-3	Potomac River AL Cnty	021405080121	POTOMAC R UT	2.14
0110-5	Potomac River AL Cnty	021405080110	BIG RUN	4.14
0121-2	Potomac River AL Cnty	021405080121	POTOMAC R UT	3.00
0121-1	Potomac River AL Cnty	021405080121	POTOMAC R UT	3.29
0120-1	Potomac River AL Cnty	021405080120	POTOMAC R UT	4.71
0119-2	Potomac River AL Cnty	021405080119	POTOMAC R UT	2.14
0119-3	Potomac River AL Cnty	021405080119	POTOMAC R UT	4.14
0119-4	Potomac River AL Cnty	021405080119	POTOMAC R UT	5.00
0110-91	Potomac River AL Cnty	021405080110	BIG RUN	4.43
0110-1	Potomac River AL Cnty	021405080110	BIG RUN	2.71
0120-2	Potomac River AL Cnty	021405080120	POTOMAC R UT	2.14
0110-94	Potomac River AL Cnty	021405080110	BIG RUN UT	3.00
0119-1	Potomac River AL Cnty	021405080119	POTOMAC R UT	3.86
0118-4	Potomac River AL Cnty	021405080118	POTOMAC R UT	2.43
0110-3	Potomac River AL Cnty	021405080110	POTOMAC R UT	1.57
0112-92	Potomac River AL Cnty	021405080112	POTOMAC R UT	3.00
0112-2	Potomac River AL Cnty	021405080112	POTOMAC R UT	3.29
0118-5	Potomac River AL Cnty	021405080118	POTOMAC R UT	1.86
0110-2	Potomac River AL Cnty	021405080110	BIG RUN	3.86
0112-4	Potomac River AL Cnty	021405080112	POTOMAC R UT	3.29
0110-4	Potomac River AL Cnty	021405080110	BIG RUN UT	2.14
0118-1	Potomac River AL Cnty	021405080118	POTOMAC R UT	1.86
0112-3	Potomac River AL Cnty	021405080112	SANDY FLAT	1.57
0112-94	Potomac River AL Cnty	021405080112	POTOMAC R UT	1.29
0112-95	Potomac River AL Cnty	021405080112	POTOMAC R UT	2.43
0112-5	Potomac River AL Cnty	021405080112	POTOMAC R UT	1.86
0112-1	Potomac River AL Cnty	021405080112	POTOMAC R UT	2.43
0114-3	Potomac River AL Cnty	021405080114	ROBY HOLLOW	4.71
0110-95	Potomac River AL Cnty	021405080110	BIG RUN	4.14
0110-93	Potomac River AL Cnty	021405080110	POTOMAC R UT	2.43
0148-2	Sideling Hill Creek	021405100148		4.43
0149-5	Sideling Hill Creek	021405100149	SIDELING HILL CR UT	4.71
0149-3	Sideling Hill Creek	021405100149	SIDELING HILL CR	3.57
0150-3	Sideling Hill Creek	021405100150	SIDELING HILL CR UT	4.14
0150-1	Sideling Hill Creek	021405100150	SIDELING HILL CR UT	3.29
0152-2	Sideling Hill Creek	021405100152		4.43
0150-2	Sideling Hill Creek	021405100150	SIDELING HILL CR UT	4.14
0148-1	Sideling Hill Creek	021405100148	SIDELING HILL CR	3.86
0149-4	Sideling Hill Creek	021405100148	SIDELING HILL CR	4.14
0152-1	Sideling Hill Creek	021405100152	SIDELING HILL CR UT	4.71
0150-5	Sideling Hill Creek	021405100150	SIDELING HILL CR UT	4.14
0152-4	Sideling Hill Creek	021405100152	SIDELING HILL CR	3.57
Site	**8-Digit Watershed**	**12-Digit Subwatershed**	**Stream name**	**Benthic IBI**
0150-4	Sideling Hill Creek	021405100150	SIDELING HILL CR UT	4.43

Potomac R Allegany County/Sideling Hill Creek

Stream Waders Data

0152-5	Sideling Hill Creek	021405100152	POOL'S HOLLOW BR	2.43
0149-1	Sideling Hill Creek	021405100149	SIDELING HILL CR	4.14
0149-2	Sideling Hill Creek	021405100151	BEAR CR	4.43
0148-5	Sideling Hill Creek	021405100148	SIDELING HILL CR	3.29
0151-1	Sideling Hill Creek	021405100151	BEAR CR	3.57
0148-4	Sideling Hill Creek	021405100148	SIDELING HILL CR	4.14
0152-3	Sideling Hill Creek	021405100152	SIDELING HILL CR UT	3.29
0148-3	Sideling Hill Creek	021405100148	SUGAR CAMP RUN	4.71
0151-3	Sideling Hill Creek	021405100151		3.57

Potomac R Allegany County/Sideling Hill Creek

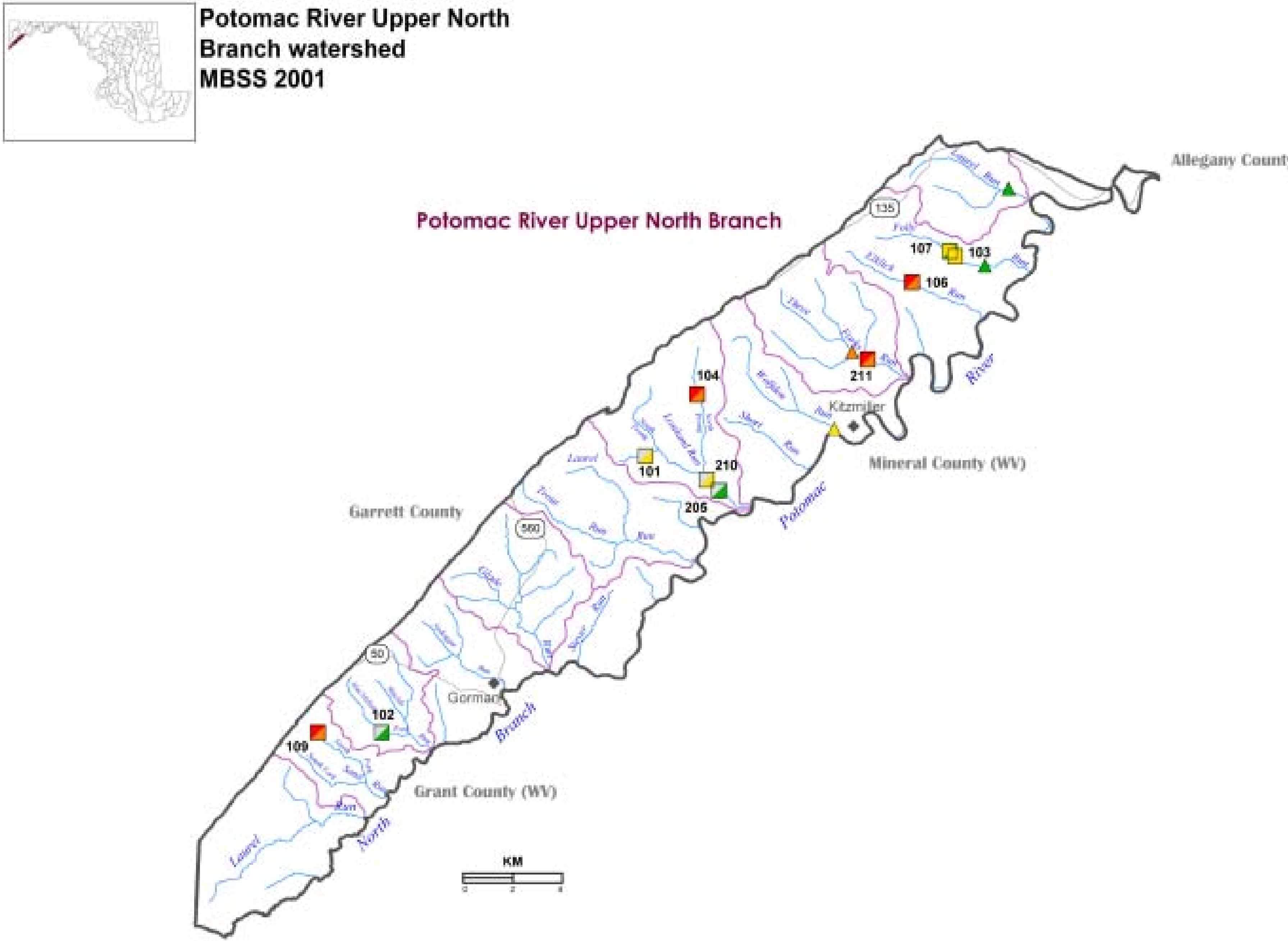
Fish Species Present
AMERICAN EEL
BLACKNOSE DACE
BLUNTNOSE MINNOW
CENTRAL STONEROLLER
CHAIN PICKEREL
COMELY SHINER
COMMON SHINER
CREEK CHUB
FALLFISH
FANTAIL DARTER
GREEN SUNFISH
GREENSIDE DARTER
LONGEAR SUNFISH
LONGNOSE DACE
MARGINED MADTOM
NORTHERN HOGSUCKER
POTOMAC SCULPIN
RAINBOW DARTER
REDBREAST SUNFISH
RIVER CHUB
ROCK BASS
ROSYFACE SHINER
SMALLMOUTH BASS
SPOTFIN SHINER
YELLOW BULLHEAD

Exotic Plants Present
MULTIFLORA ROSE
MICROSTEGIUM

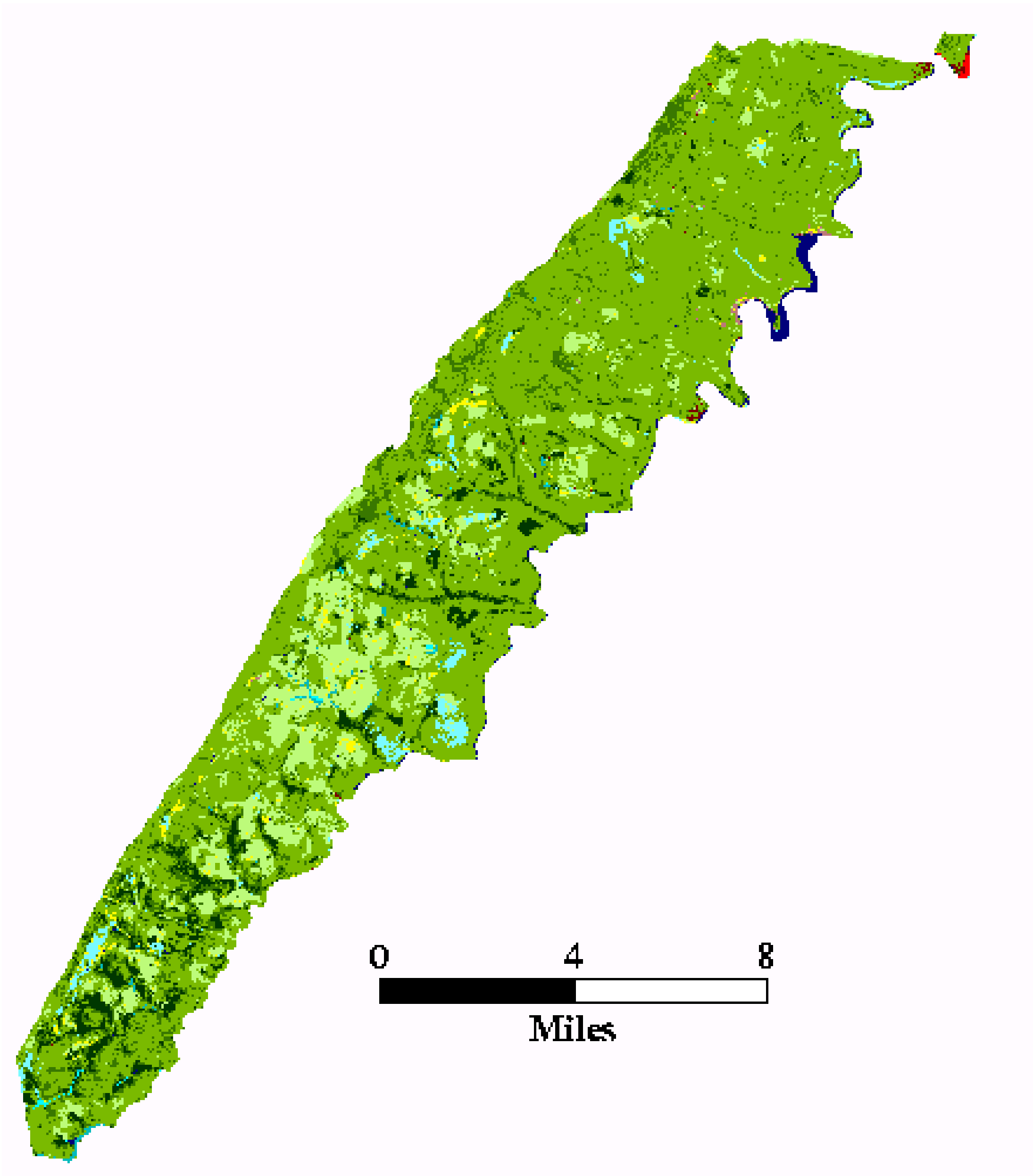
Benthic Taxa Present
ACERPENNA
ACRONEURIA
ALLOCAPNIA
AMELETUS
AMPHINEMURA
ATHERIX
BAETIDAE
BRACHYCENTRIDAE
CAECIDOTEA
CAENIS
CAMBARIDAE
CERATOPOGON
CHAETOCLADIUS
CHEUMATOPSYCHE
CHLOROPERLIDAE
CLINOCERA
CONCHAPELOPIA
CORDULEGASTER
CORYNONEURA
CRANGONYX
CRICOTOPUS/ORTHOCLADIUS
CURA
DIAMESA
DIAMESINAE
DICRANOTA
DIPLECTRONA
DIPLOCLADIUS
DIXA
DOLOPHILODES
DRUNELLA
ENCHYTRAEIDAE
EPEORUS
EPHEMERELLA
EPHEMERELLIDAE
EUKIEFFERIELLA
EURYLOPHELLA
FERRISSIA
GLOSSOSOMATIDAE
HELICHUS
HEMERODROMIA
HEPTAGENIIDAE
HETEROTRISSOCLADIUS
HEXATOMA
HOMOPLECTRA
HYDROPSYCHE
IRONOQUIA
ISONYCHIA
ISOTOMURUS
LEPIDOSTOMA
LEPTOPHLEBIIDAE
LEUCROCUTA
LEUCTRA
LEUCTRIDAE
LUMBRICULIDAE
MICROPSECTRA
MICROTENDIPES
NEMOURIDAE
NEOPHYLAX
NIGRONIA
OEMOPTERYX
OPTIOSERVUS
ORMOSIA
ORTHOCLADIUS
PARALEPTOPHLEBIA
PARAMETRIOCNEMUS
PARAPHAENOCLADIUS
PERLIDAE
PERLODIDAE
PHILOPOTAMIDAE
PROBEZZIA
PROSIMULIUM
PROSTOIA
PSEPHENUS
PTERONARCYS
PYCNOPSYCHE
RHYACOPHILA
SIMULIUM
SPHAERIIDAE
STEGOPTERNA
STEMPELLINA
STENACRON
STENONEMA
STROPHOPTERYX
SWELTSA
TANYPODINAE
TANYTARSINI
TANYTARSUS
THIENEMANNIELLA
THIENEMANNIMYIA GROUP
TIPULA
TUBIFICIDAE
TVETENIA
WORMALDIA

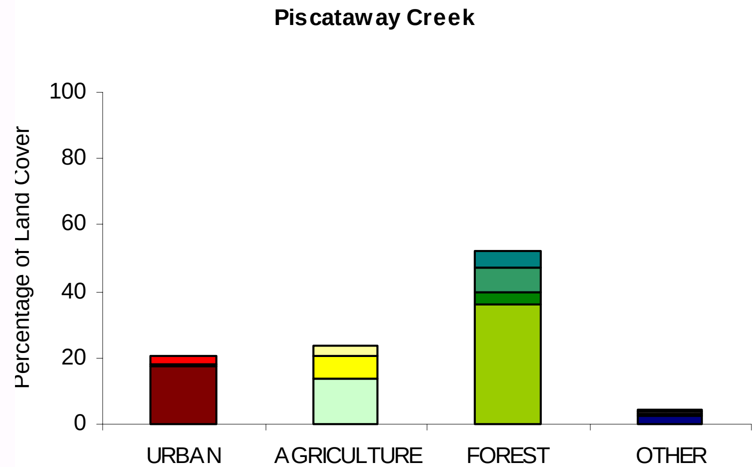
Herpetofauna Present
EASTERN BOX TURTLE
GREEN FROG
NORTHERN DUSKY SALAMANDER
NORTHERN SLIMY SALAMANDER
NORTHERN SPRING SALAMANDER
NORTHERN TWO-LINED SALAMANDER
RED SALAMANDER
RED SPOTTED NEWT

Potomac River Upper North Branch watershed MBSS 2001



Potomac River Upper North Branch





Potomac River Upper North Branch

Site Information

Site	Stream Name	12-Digit Subwatershed Code	8-digit Watershed	Basin	County	Date Sampled Spring	Date Sampled Summer	Order	Catchment Area (acres)
PRUN-101-R-2001	SOUTH PRONG LOSTLAND RUN UT1	021410050046	Potomac River (Upper North Branch)	NORTH BR POTOMAC RIVER	Garrett	02-Apr-01	25-Jun-01	1	505
PRUN-102-R-2001	MCMILLAN FORK OF SHIELDS RUN	021410050041	Potomac River (Upper North Branch)	NORTH BR POTOMAC RIVER	Garrett	02-Apr-01	20-Aug-01	1	1227
PRUN-103-R-2001	FOLLY RUN	021410050049	Potomac River (Upper North Branch)	NORTH BR POTOMAC RIVER	Garrett	28-Mar-01	16-Aug-01	1	2079
PRUN-104-R-2001	NORTH PRONG LOSTLAND RUN	021410050046	Potomac River (Upper North Branch)	NORTH BR POTOMAC RIVER	Garrett	02-Apr-01	15-Aug-01	1	1608
PRUN-106-R-2001	ELK LICK RUN	021410050049	Potomac River (Upper North Branch)	NORTH BR POTOMAC RIVER	Garrett	28-Mar-01	15-Aug-01	1	1387
PRUN-107-R-2001	FOLLY RUN	021410050049	Potomac River (Upper North Branch)	NORTH BR POTOMAC RIVER	Garrett	28-Mar-01	16-Aug-01	1	1942
PRUN-109-R-2001	NORTH FORK OF SAND RUN	021410050040	Potomac River (Upper North Branch)	NORTH BR POTOMAC RIVER	Garrett	02-Apr-01	6-Aug-01	1	431
PRUN-205-R-2001	LOSTLAND RUN	021410050046	Potomac River (Upper North Branch)	NORTH BR POTOMAC RIVER	Garrett	02-Apr-01	25-Jun-01	2	6222
PRUN-210-R-2001	LOSTLAND RUN	021410050046	Potomac River (Upper North Branch)	NORTH BR POTOMAC RIVER	Garrett	02-Apr-01	25-Jun-01	2	6043
PRUN-211-R-2001	THREE FORKS RUN	021410050048	Potomac River (Upper North Branch)	NORTH BR POTOMAC RIVER	Garrett	02-Apr-01	25-Jun-01	2	5380

Indicator Information

Site	FIBI	BIBI	PHI	Brook Trout Present	Black Water Stream
PRUN-101-R-2001	NR	3.44	92.05	1	0
PRUN-102-R-2001	NR	4.56	75.01	1	0
PRUN-103-R-2001	3.57	3.44	95.71	1	0
PRUN-104-R-2001	1.00	2.11	99.98	0	0
PRUN-106-R-2001	1.00	2.56	93.43	0	0
PRUN-107-R-2001	3.00	4.11	94.58	1	0
PRUN-109-R-2001	1.86	2.33	98.73	0	0
PRUN-205-R-2001	NR	4.33	94.98	1	0
PRUN-210-R-2001	NR	3.22	90.06	1	0
PRUN-211-R-2001	1.00	2.56	86.49	0	0

Catchment Land Use Information

Site	Percent Urban	Percent Agriculture	Percent Forest	Percent Other	Percent Impervious Surface
PRUN-101-R-2001	0.00	34.67	64.27	1.06	0.00
PRUN-102-R-2001	0.15	9.75	89.22	0.87	0.04
PRUN-103-R-2001	0.11	3.00	96.47	0.42	0.03
PRUN-104-R-2001	0.02	8.83	89.90	1.26	0.01
PRUN-106-R-2001	0.09	6.80	92.22	0.89	0.02
PRUN-107-R-2001	0.11	3.05	96.63	0.21	0.03
PRUN-109-R-2001	0.00	9.30	86.75	3.95	0.00
PRUN-205-R-2001	0.05	11.66	86.48	1.82	0.01
PRUN-210-R-2001	0.05	11.97	86.10	1.87	0.01
PRUN-211-R-2001	0.06	5.00	92.45	2.49	0.01

Interpretation of Watershed Condition

- ANC/pH values low and sulfate values high at all sites - indicative of acid mine drainage effects

- Surface mines present at many sites
- Physical habitat parameters generally good
- Lime doser observed upstream of sites 210 and 211

Potomac River Upper North Branch

Water Chemistry Information

Site	Closed pH	Specific Cond.	ANC (µeq/L)	Cl (mg/L)	Nitrate-N (mg/L)	SO4 (mg/L)	T-P (mg/L)	Ortho-P (mg/L)	Nitrite (mg/L)	Ammonia (mg/L)	T-N (mg/L)	DOC (mg/L)	DO (mg/L)	Turbidity (mg/L)
PRUN-101-R-2001	7.78	403.9	1459.3	1.391	0.238	128.194	0.0066	0.001	0.0007	0.012	0.291	1.047	10.8	5.1
PRUN-102-R-2001	7.07	128.0	301.6	4.658	0.713	27.252	0.0059	0.001	0.0010	0.005	0.712	0.677	11.1	1.7
PRUN-103-R-2001	6.69	139.6	43.2	27.040	0.685	11.055	0.0055	0.001	0.0004	0.002	0.685	0.496	7	2.3
PRUN-104-R-2001	4.73	44.0	-24.0	0.771	0.154	12.207	0.0047	0.001	0.0006	0.005	0.176	1.089	9.1	1.8
PRUN-106-R-2001	4.89	361.4	-7.5	9.373	0.660	136.187	0.0046	0.001	0.0004	0.018	0.714	0.454	8.4	3.4
PRUN-107-R-2001	6.63	139.9	43.5	29.406	0.609	11.047	0.0042	0.001	0.0004	0.002	0.615	0.622	7	2.3
PRUN-109-R-2001	6.94	301.1	241.3	10.277	0.670	90.886	0.0137	0.001	0.0050	0.029	0.768	1.247	8.3	4
PRUN-205-R-2001	6.90	147.7	189.0	1.067	0.309	44.381	0.0046	0.001	0.0010	0.003	0.278	0.504	10.2	3.3
PRUN-210-R-2001	7.22	140.4	186.5	1.047	0.298	45.903	0.0068	0.001	0.0007	0.004	0.266	0.881	12.7	3.4
PRUN-211-R-2001	4.86	338.5	-9.3	24.472	0.684	101.047	0.0327	0.001	0.0032	0.016	0.741	0.547	10.8	17.5

Physical Habitat Condition

Site	Riparian Buffer Width Left	Riparian Buffer Width Right	Adjacent Cover Left	Adjacent Cover Right	Instream Habitat Structure	Epifaunal Substrate	Velocity/ Depth Diversity	Pool/ Glide/ Eddy Quality	Extent of Pools (m)	Riffle/ Run Quality	Extent of Riffles (m)	Embedded-ness	Shading	Trash Rating	Maximum Depth (cm)
PRUN-101-R-2001	50	50	FR	FR	15	10	9	10	48	11	37	35	80	16	40
PRUN-102-R-2001	50	50	FR	FR	13	14	10	7	44	13	38	45	25	19	26
PRUN-103-R-2001	50	50	FR	FR	18	17	15	16	23	19	59	15	94	20	55
PRUN-104-R-2001	50	50	FR	FR	19	18	15	17	26	17	55	25	98	20	71
PRUN-106-R-2001	50	50	FR	FR	17	16	15	16	29	18	65	25	95	18	78
PRUN-107-R-2001	50	50	FR	FR	18	17	10	16	45	19	50	15	90	20	46
PRUN-109-R-2001	0	0	GR	GR	17	11	14	17	47	14	33	40	25	16	78
PRUN-205-R-2001	50	50	FR	FR	19	18	18	16	35	20	55	15	90	19	78
PRUN-210-R-2001	50	50	FR	FR	17	18	16	16	25	18	70	15	89	19	58
PRUN-211-R-2001	50	28	FR	GR	16	11	15	16	15	19	75	50	92	15	64

Physical Habitat Modifications

Site	Buffer Breaks?	Surface Mine?	Landfill?	Channelization?	Erosion Severity Left	Erosion Severity Right	Bar Formation
PRUN-101-R-2001	Y	N	N	N	Moderate	Moderate	Severe
PRUN-102-R-2001	N	N	N	N	Mild	Mild	Moderate
PRUN-103-R-2001	N	Y	N	N	None	None	Minor
PRUN-104-R-2001	N	N	N	N	None	None	Minor
PRUN-106-R-2001	N	Y	N	N	None	None	Minor
PRUN-107-R-2001	N	Y	N	N	None	None	Minor
PRUN-109-R-2001	Y	N	N	Y	Mild	Mild	Minor
PRUN-205-R-2001	N	Y	N	N	None	None	Minor
PRUN-210-R-2001	N	Y	N	N	Moderate	None	Moderate
PRUN-211-R-2001	Y	Y	N	N	Mild	Mild	Minor

Potomac River Upper North Branch

Stream Waders Data

Site	8-Digit Watershed	12-Digit Subwatershed	Stream name	Benthic IBI
0047-1	Potomac River U N Branch	021410050047	WOLFDEN RUN	3.86
0048-1	Potomac River U N Branch	021410050048	THREE FORKS RUN	2.71
0046-1	Potomac River U N Branch	021410050046	LOST LAND RUN	3.57
0049-1	Potomac River U N Branch	021410050049	FOLLY RUN	4.71
0050-1	Potomac River U N Branch	021410050050	LAUREL RUN	4.71

Potomac River Upper North Branch

Fish Species Present
BLACKNOSE DACE
BROOK TROUT
CREEK CHUB
FANTAIL DARTER
GREEN SUNFISH
WHITE SUCKER

Exotic Plants Present
MULTIFLORA ROSE
THISTLE

Benthic Taxa Present
CAMBARIDAE
CAMBARUS
AMELETUS
EPHEMERA
CORDULEGASTER
SWELTSA
LEUCTRA
AMPHINEMURA
OSTROCERCA
PERLIDAE
ACRONEURIA
CHIRONOMIDAE
MICROPSECTRA
TANYTARSUS
CORYNONEURA
CRICOTOPUS/ORTHOCLADIUS
PARAMETRIOCNEMUS
TVETENIA
TANYPUS
ZAVRELIMYIA
PROSIMULIUM
STEGOPTERNA
CHRYSOPS
HEXATOMA
PSEUDOLIMNOPHILA
TIPULA
AMELETUS
PARALEPTOPHLEBIA
EPHEMERELLA
EPEORUS
STENONEMA
SWELTSA
LEUCTRA
NEMOURIDAE
AMPHINEMURA
TALLAPERLA
ACRONEURIA
PERLODIDAE
OEMOPTERYX
HYDROPSYCHE
CHIMARRA
WORMALDIA
RHYACOPHILA
NEOPHYLAX
OULIMNIUS
MICROTENDIPES
MICROPSECTRA
PARAMETRIOCNEMUS
THIENEMANNIMYIA GROUP
DOLICHOPODIDAE
PROSIMULIUM
ERIOPTERA
ENCHYTRAEIDAE
LUMBRICULIDAE
EPHEMERELLA
SWELTSA
LEUCTRA
AMPHINEMURA
PELTOPERLA
HYDROPSYCHE
DOLOPHILODES
POLYCENTROPUS
RHYACOPHILA
OULIMNIUS
BEZZIA
CERATOPOGON
POLYPEDILUM
MICROPSECTRA
STEMPELLINELLA
BRILLIA
EUKIEFFERIELLA
PARACHAETOCLADIUS
PARAPHAENOCLADIUS
TVETENIA
PROSIMULIUM
DICRANOTA
HEXATOMA
TIPULA
POTAMYIA
LEUCTRA
NEMOURIDAE
AMPHINEMURA
OEMOPTERYX
RHYACOPHILA
NEOPHYLAX
PROBEZZIA
TANYTARSUS
EUKIEFFERIELLA
HELENIELLA
THIENEMANNIELLA
THIENEMANNIMYIA GROUP
CHELIFERA
PROSIMULIUM
ENCHYTRAEIDAE
SWELTSA
LEUCTRIDAE
PARALEUCTRA
DIPLECTRONA
HYDATOPHYLAX
NYCTIOPHYLAX
RHYACOPHILA
CERATOPOGON
TANYTARSINI
ORTHOCLADIINAE
PARAPHAENOCLADIUS
PSILOMETRIOCNEMUS
DICRANOTA
MOLOPHILUS
EPHEMERELLA
EPEORUS
NIXE
CHLOROPERLIDAE
SWELTSA
LEUCTRIDAE
LEUCTRA
AMPHINEMURA
ACRONEURIA
PERLODIDAE
PTERONARCYS
DIPLECTRONA
WORMALDIA
POLYCENTROPODIDAE
OULIMNIUS
CHIRONOMINI
TANYTARSINI
MICROPSECTRA
STEMPELLINELLA
ORTHOCLADIINAE
PARACHAETOCLADIUS
PROSIMULIUM
DICRANOTA
HEXATOMA
GOMPHIDAE
LEUCTRA
NEMOURIDAE
AMPHINEMURA
CHEUMATOPSYCHE
DIPLECTRONA
HYDROPSYCHE
PLATYCENTROPUS
PYCNOPSYCHE
CHIMARRA
LYPE

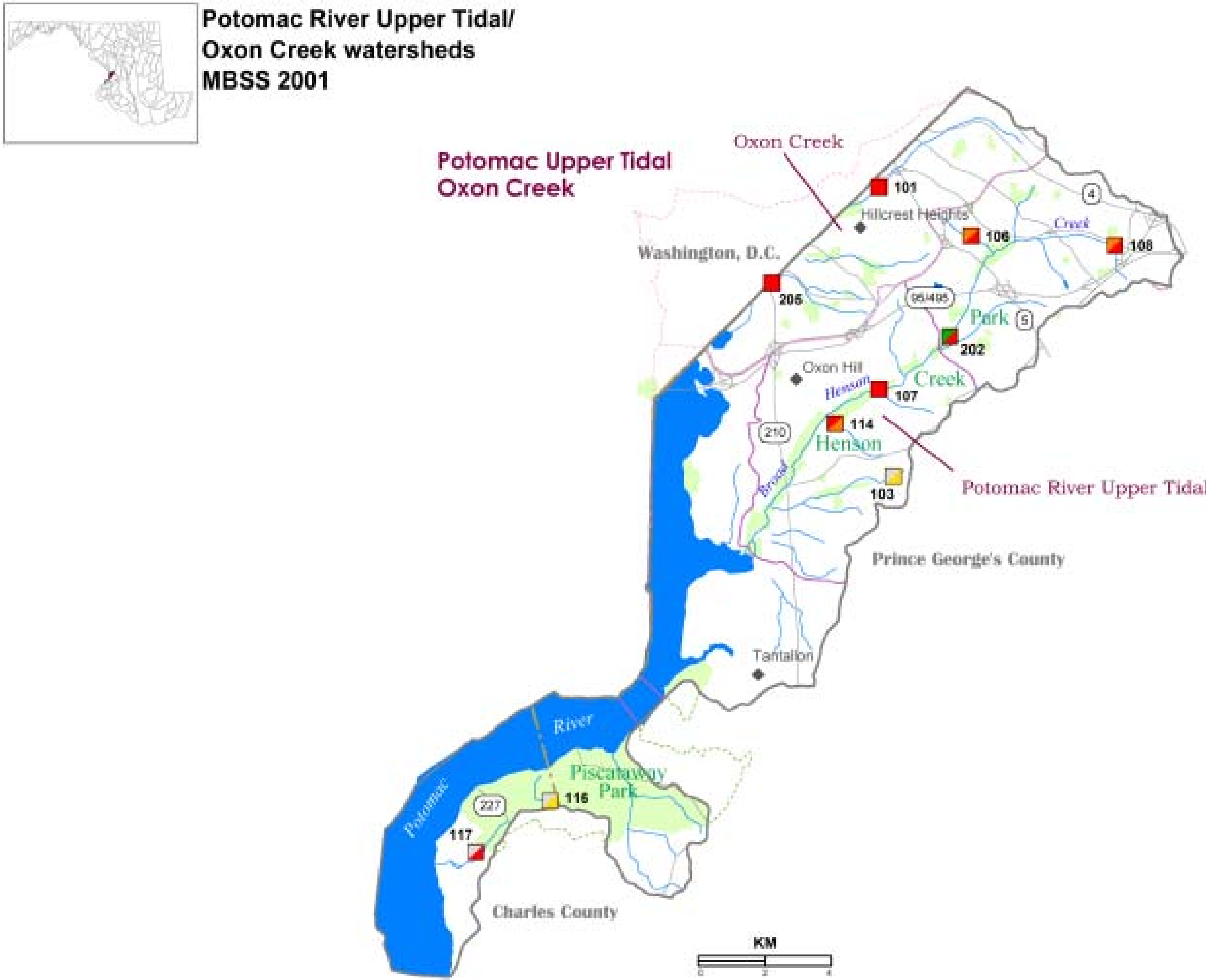
Potomac River Upper North Branch

OPTIOSERVUS
PROBEZZIA
LIMNOPHYES
UNNIELLA
MEROPELOPIA
ZAVRELIMYIA
HEMERODROMIA
PSEUDOLIMNOPHILA
ENCHYTRAEIDAE
NAIDIDAE
AMELETUS
EPHEMERELLA
EPEORUS
STENONEMA
ACENTRELLA
BAETIS
SWELTSA
AMPHINEMURA
TALLAPERLA
ACRONEURIA
TAENIOPTERYX
DIPLECTRONA
HYDROPSYCHE
POLYCENTROPUS
CERATOPOGON
MICROPSECTRA
PARACHAETOCLADIUS
PARAMETRIOCNEMUS
PARAPHAENOCLADIUS
CHRYSOPS
HEXATOMA
LUMBRICULIDAE
AMELETUS
EPEORUS
BAETIS
SWELTSA
LEUCTRA
AMPHINEMURA
ACRONEURIA
PERLODIDAE
TAENIOPTERYX
GLOSSOSOMA
HYDROPSYCHE
MICROPSECTRA
PARAMETRIOCNEMUS
PARAPHAENOCLADIUS
DICRANOTA
HEXATOMA
ENCHYTRAEIDAE
PARACAPNIA
LEUCTRA
NEMOURIDAE
TALLAPERLA
SIALIS
POLYCENTROPUS
PROBEZZIA
POLYPEDILUM
ORTHOCLADIINAE
LIMNOPHYES
PARACHAETOCLADIUS
ERIOPTERA
TIPULA
THIENEMANNIMYIA GROUP
OLIGOSTOMIS

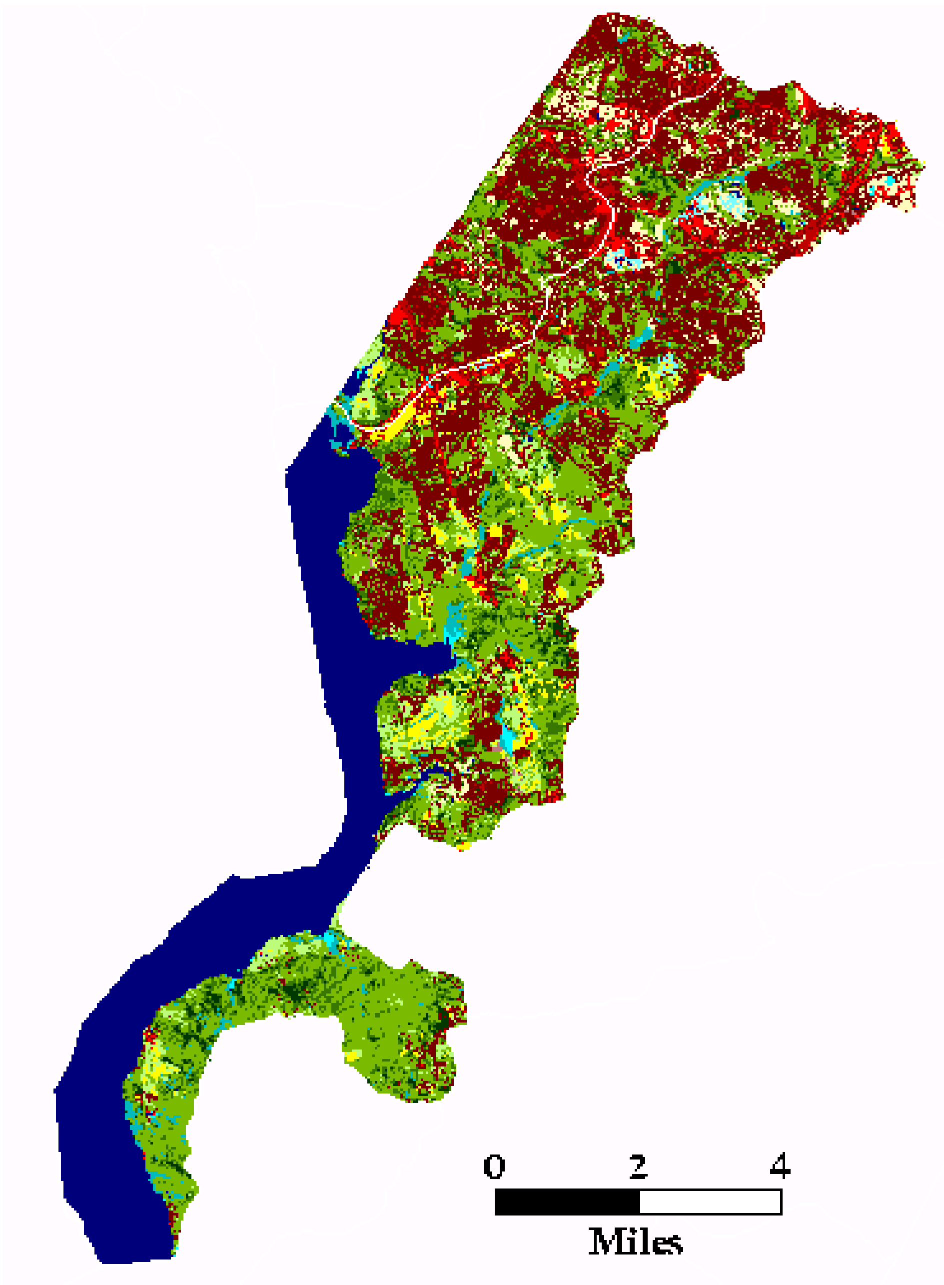
Herpetofauna Present

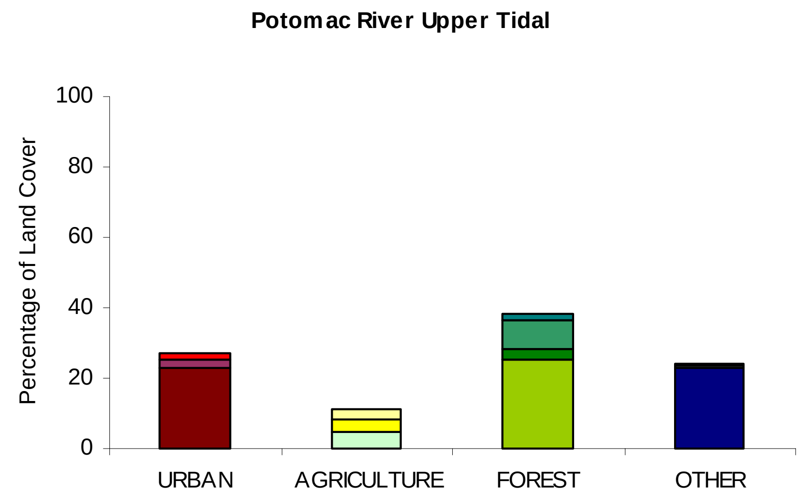
GREEN FROG
MOUNTAIN DUSKY SALAMANDER
NORTHERN DUSKY SALAMANDER
NORTHERN SPRING SALAMANDER
RED SALAMANDER
RED SPOTTED NEWT
SEAL SALAMANDER
WOOD FROG

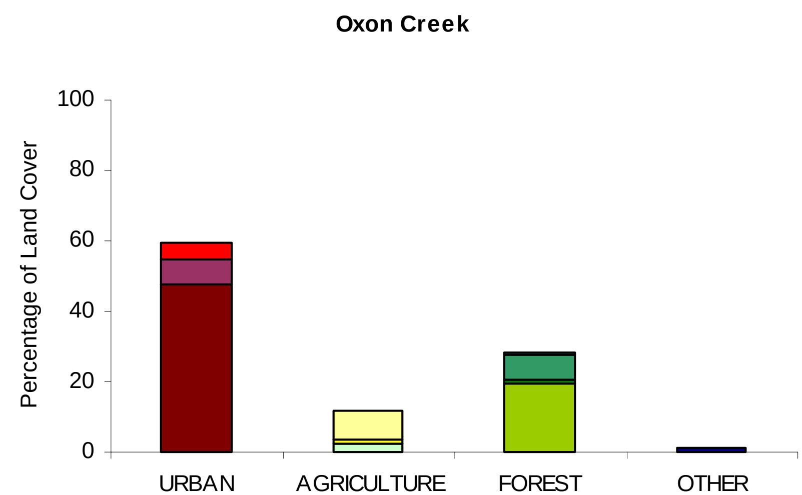
Potomac River Upper Tidal/ Oxon Creek watersheds MBSS 2001



Potomac Upper Tidal/Oxon Creek







Potomac Upper Tidal/Oxon Creek

Site Information

Site	Stream Name	12-Digit Subwatershed Code	8-digit Watershed	Basin	County	Date Sampled Spring	Date Sampled Summer	Order	Catchment Area (acres)
OXON-101-R-2001	OXON RUN	021402040805	Oxon CR	WASHINGTON METROPOLITAN	Prince Georges	20-Mar-01	9-Jul-01	1	3090
OXON-205-R-2001	OXON RUN UT1	021402040805	Oxon CR	WASHINGTON METROPOLITAN	Prince Georges	20-Mar-01	9-Jul-01	2	1166
PRUT-103-R-2001	HUNTERS MILL BRANCH	021402010796	Potomac River (Upper-tidal)	WASHINGTON METROPOLITAN	Prince Georges	19-Mar-01	12-Jul-01	1	78
PRUT-106-R-2001	HENSON CR UT1	021402010797	Potomac River (Upper-tidal)	WASHINGTON METROPOLITAN	Prince Georges	20-Mar-01	6-Aug-01	1	325
PRUT-107-R-2001	HENSON CR UT2	021402010796	Potomac River (Upper-tidal)	WASHINGTON METROPOLITAN	Prince Georges	19-Mar-01	9-Jul-01	1	673
PRUT-108-R-2001	HENSON CR	021402010797	Potomac River (Upper-tidal)	WASHINGTON METROPOLITAN	Prince Georges	20-Mar-01	10-Jul-01	1	1137
PRUT-114-R-2001	HENSON CR UT3	021402010796	Potomac River (Upper-tidal)	WASHINGTON METROPOLITAN	Prince Georges	19-Mar-01	9-Jul-01	1	359
PRUT-116-R-2001	POTOMAC RIVER UT13	021402010792	Potomac River (Upper-tidal)	WASHINGTON METROPOLITAN	Charles	15-Mar-01	3-Jul-01	1	84
PRUT-117-R-2001	POTOMAC RIVER UT12	021402010792	Potomac River (Upper-tidal)	LOWER POTOMAC RIVER	Charles	15-Mar-01	3-Jul-01	1	210
PRUT-202-R-2001	HENSON CR	021402010797	Potomac River (Upper-tidal)	LOWER POTOMAC RIVER	Prince Georges	20-Mar-01	10-Jul-01	2	6118

Indicator Information

Site	FIBI	BIBI	PHI	Brook Trout Present	Black Water Stream
OXON-101-R-2001	1.00	1.57	55.13	0	0
OXON-205-R-2001	1.00	1.00	1.10	0	0
PRUT-103-R-2001	NR	3.00	24.27	0	0
PRUT-106-R-2001	2.50	1.57	62.32	0	0
PRUT-107-R-2001	1.00	1.57	6.69	0	0
PRUT-108-R-2001	2.50	1.57	71.76	0	0
PRUT-114-R-2001	1.75	2.71	65.37	0	0
PRUT-116-R-2001	NR	3.00	81.34	0	0
PRUT-117-R-2001	NR	1.57	21.93	0	1
PRUT-202-R-2001	4.50	1.57	88.98	0	0

Catchment Land Use Information

Site	Percent Urban	Percent Agriculture	Percent Forest	Percent Other	Percent Impervious Surface
OXON-101-R-2001	65.08	12.19	22.59	0.13	22.54
OXON-205-R-2001	62.29	8.27	29.39	0.05	20.35
PRUT-103-R-2001	39.11	11.29	49.60	0.00	10.38
PRUT-106-R-2001	60.00	7.67	32.33	0.00	24.51
PRUT-107-R-2001	46.40	7.21	46.35	0.05	12.61
PRUT-108-R-2001	59.93	19.56	15.21	5.29	26.04
PRUT-114-R-2001	16.61	20.39	62.83	0.18	4.24
PRUT-116-R-2001	5.68	14.77	79.55	0.00	1.42
PRUT-117-R-2001	0.00	3.58	96.12	0.30	0.00
PRUT-202-R-2001	56.30	13.86	27.05	2.79	21.28

Interpretation of Watershed Condition

- Most sites located in very urbanized catchments
- Chloride levels elevated at most sites
- Nitrogen levels (specifically ammonia) elevated at many sites
- Channelization is a major problem; many physical habitat parameters poor
- Sewage smell noted at many sites
- Orange floc noted at site 107 and 116

Potomac Upper Tidal/Oxon Creek

Water Chemistry Information

Site	Closed pH	Specific Cond.	ANC (µeq/L)	Cl (mg/L)	Nitrate-N (mg/L)	SO4 (mg/L)	T-P (mg/L)	Ortho-P (mg/L)	Nitrite (mg/L)	Ammonia (mg/L)	T-N (mg/L)	DOC (mg/L)	DO (mg/L)	Turbidity (mg/L)
OXON-101-R-2001	7.52	615.5	832.9	101.050	0.852	37.151	0.0146	0.001	0.0084	0.050	1.045	3.006	8.3	22.8
OXON-205-R-2001	7.39	442.3	634.9	65.708	0.662	47.344	0.0436	0.001	0.0026	0.153	1.462	3.221	8	9.3
PRUT-103-R-2001	6.44	246.8	159.4	45.138	0.878	19.007	0.0097	0.001	0.0005	0.012	1.048	1.941	7.4	4.7
PRUT-106-R-2001	6.98	291.9	409.3	47.254	1.017	19.865	0.0193	0.001	0.0004	0.028	1.248	2.441	7.4	2.1
PRUT-107-R-2001	7.10	323.7	458.7	49.919	0.746	29.714	0.0140	0.001	0.0034	0.080	0.998	1.697	7.3	14.5
PRUT-108-R-2001	6.69	639.2	376.3	147.662	0.746	24.460	0.0140	0.001	0.0008	0.166	1.048	2.835	6.9	9.4
PRUT-114-R-2001	7.58	276.1	768.4	29.957	0.296	33.017	0.0111	0.004	0.0013	0.007	0.357	1.508	8.8	4.3
PRUT-116-R-2001	6.84	89.8	249.3	8.522	0.508	9.646	0.0073	0.001	0.0004	0.008	0.545	1.275	7.2	2.5
PRUT-117-R-2001	4.91	65.5	-12.6	4.390	0.001	14.433	0.0229	0.001	0.0004	0.036	0.422	9.081	2.3	14.9
PRUT-202-R-2001	7.48	493.7	765.8	92.507	0.791	28.638	0.0243	0.001	0.0124	0.124	1.149	3.272	8.2	10.5

Physical Habitat Condition

Site	Riparian Buffer Width Left	Riparian Buffer Width Right	Adjacent Cover Left	Adjacent Cover Right	Instream Habitat Structure	Epifaunal Substrate	Velocity/ Depth Diversity	Pool/ Glide/ Eddy Quality	Extent of Pools (m)	Riffle/ Run Quality	Extent of Riffles (m)	Embed-dedness	Shading	Trash Rating	Maximum Depth (cm)
OXON-101-R-2001	50	10	FR	PK	17	16	10	10	35	15	50	50	95	2	49
OXON-205-R-2001	3	1	PV	PK	1	1	1	0	0	2	75	100	45	3	17
PRUT-103-R-2001	50	50	OF	OF	9	9	7	7	48	6	27	50	98	10	27
PRUT-106-R-2001	50	50	FR	FR	13	17	9	9	53	10	29	15	75	13	46
PRUT-107-R-2001	50	50	FR	FR	7	3	4	6	65	4	20	100	98	4	31
PRUT-108-R-2001	37	50	GR	FR	9	8	12	12	46	11	32	25	85	4	120
PRUT-114-R-2001	32	12	PV	PV	16	13	10	10	35	12	45	20	95	6	48
PRUT-116-R-2001	3	50	DI	FR	16	17	11	11	27	9	62	26	87	15	65
PRUT-117-R-2001	50	15	FR	HO	17	16	4	10	75	0	0	100	90	5	10
PRUT-202-R-2001	50	15	FR	PV	18	13	15	14	55	16	22	30	60	4	90

Physical Habitat Modifications

Site	Buffer Breaks?	Surface Mine?	Landfill?	Channelization?	Erosion Severity Left	Erosion Severity Right	Bar Formation
OXON-101-R-2001	Y	N	N	Y	Moderate	Moderate	Moderate
OXON-205-R-2001	Y	N	N	Y	None	None	Minor
PRUT-103-R-2001	N	N	N	N	Moderate	Moderate	Moderate
PRUT-106-R-2001	N	N	N	Y	Moderate	Moderate	Severe
PRUT-107-R-2001	N	N	N	N	None	None	None
PRUT-108-R-2001	N	N	N	N	Severe	Severe	Severe
PRUT-114-R-2001	Y	N	N	Y	Mild	Mild	Moderate
PRUT-116-R-2001	N	N	N	N	Severe	Moderate	Severe
PRUT-117-R-2001	N	N	N	Y	None	None	None
PRUT-202-R-2001	N	N	N	Y	Moderate	None	Severe

Potomac Upper Tidal/Oxon Creek

Stream Waders Data

No Stream Waders sites were sampled in 2001

Potomac Upper Tidal/Oxon Creek

Fish Species Present

AMERICAN EEL
BANDED KILLIFISH
BLACKNOSE DACE
BLUEGILL
BROWN BULLHEAD
CENTRAL STONEROLLER
CHAIN PICKEREL
CREEK CHUB
CREEK CHUBSUCKER
EASTERN MUDMINNOW
EASTERN SILVERY MINNOW
GOLDFISH
GREEN SUNFISH
LONGNOSE DACE
MUMMICHOG
PUMPKINSEED
REDBREAST SUNFISH
ROSYSIDE DACE
SATINFIN SHINER
SWALLOWTAIL SHINER
TESSELLATED DARTER
WHITE SUCKER
WHITE SUCKER
YELLOW BULLHEAD

Exotic Plants Present

JAPANESE HONEYSUCKLE
MULTIFLORA ROSE
MILE-A-MINUTE
MICROSTEGIUM

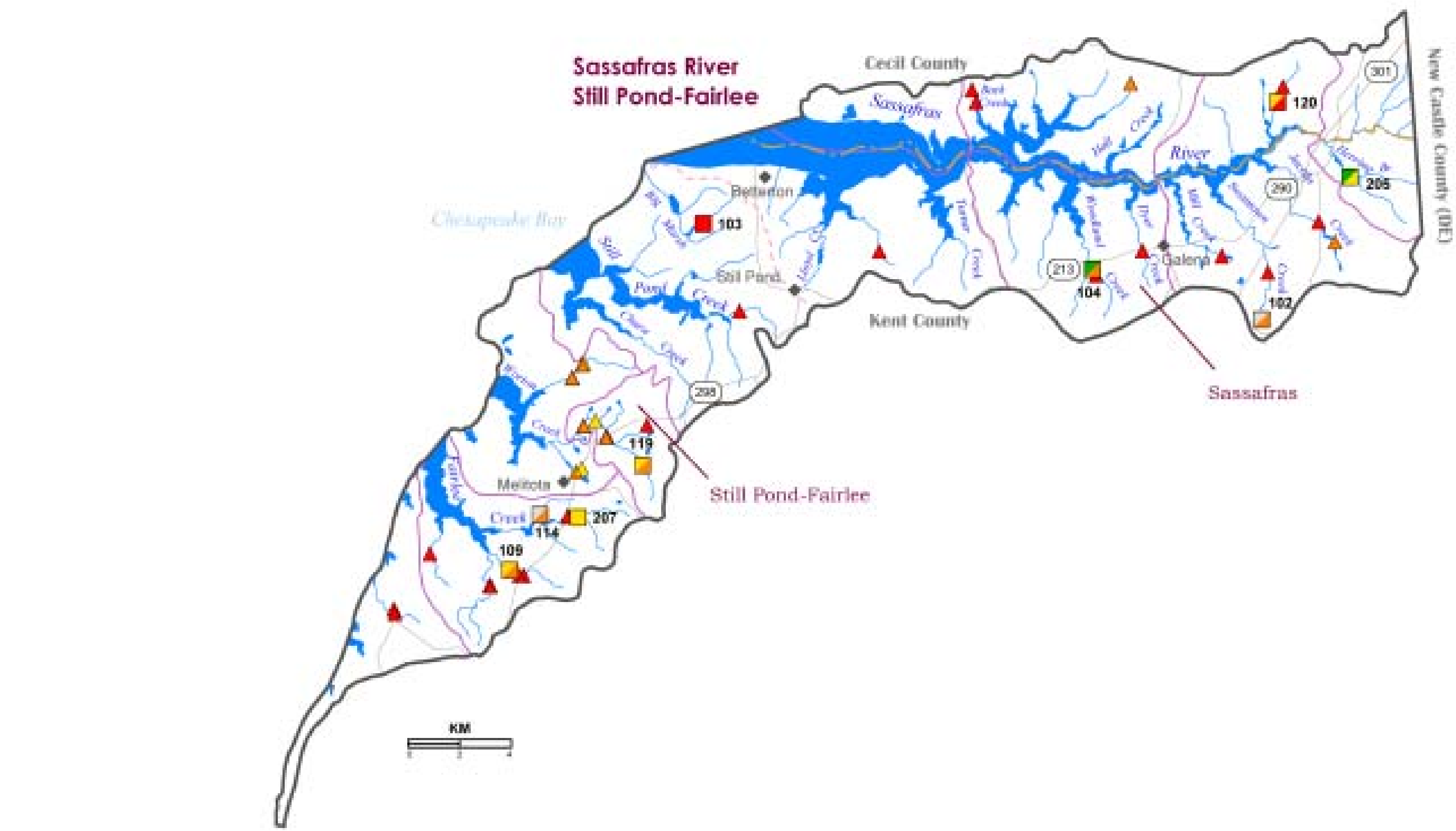
Benthic Taxa Present

ABLABESMYIA
AMELETUS
AMPHINEMURA
ANTOCHA
ARGIA
ASELLIDAE
BOYERIA
BRILLIA
CAECIDOTEA
CALOPTERYX
CAMBARIDAE
CARDIOCLADIUS
CERATOPOGON
CERATOPOGONIDAE
CHELIFERA
CHEUMATOPSYCHE
CHLOROPERLIDAE
CLINOCERA
CONCHAPELOPIA
CRANGONYX
CRICOTOPUS
CRICOTOPUS/ORTHOCLADIUS
CRYPTOCHIRONOMUS
CULICOIDES
DIAMESA
DIPLECTRONA
DIPTERA
ENCHYTRAEIDAE
EUKIEFFERIELLA
EURYLOPHELLA
GAMMARUS
GORDIIDAE
HEMERODROMIA
HETEROTRISSOCLADIUS
HIRUDINEA
HYDROPORUS
HYDROPSYCHE
IRONOQUIA
ISOTOMURUS
LANTHUS
LEPIDOPTERA
LEUCTRA
LIMNEPHILIDAE
LIMNODRILUS
LIMNOPHYES
LUMBRICULIDAE
LYPE
MENETUS
MEROPELOPIA
NAIDIDAE
NEOPHYLAX
NIGRONIA
OPTIOSERVUS
ORTHOCLADIINAE
ORTHOCLADIINAE A
ORTHOCLADIUS
OULIMNIUS
PARACHAETOCLADIUS
PARACHIRONOMUS
PARAMETRIOCNEMUS
PARATANYTARSUS
PERLODIDAE
PHAENOPSECTRA
PHAGOCATA
PHILOPOTAMIDAE
PHYSELLA
PISCICOLA
POLYCENTROPUS
POLYPEDILUM
PROCLADIUS
PRODIAMESA
PROSIMULIUM
PROSTOIA
PROSTOMA
PSECTROCLADIUS
PSEUDOLIMNOPHILA
PYRALIDAE
RHEOCRICOTOPUS
RHEOTANYTARSUS
SPHAERIIDAE
SPIROSPERMA
STAGNICOLA
STEGOPTERNA
STENELMIS
STICTOCHIRONOMUS
STILOBEZZIA
SUBLETTEA
SYNURELLA
TANYPODINAE
TANYTARSUS
TIPULA
TRIBELOS
TRISSOPELOPIA
TUBIFICIDAE
TVETENIA
ZAVRELIMYIA

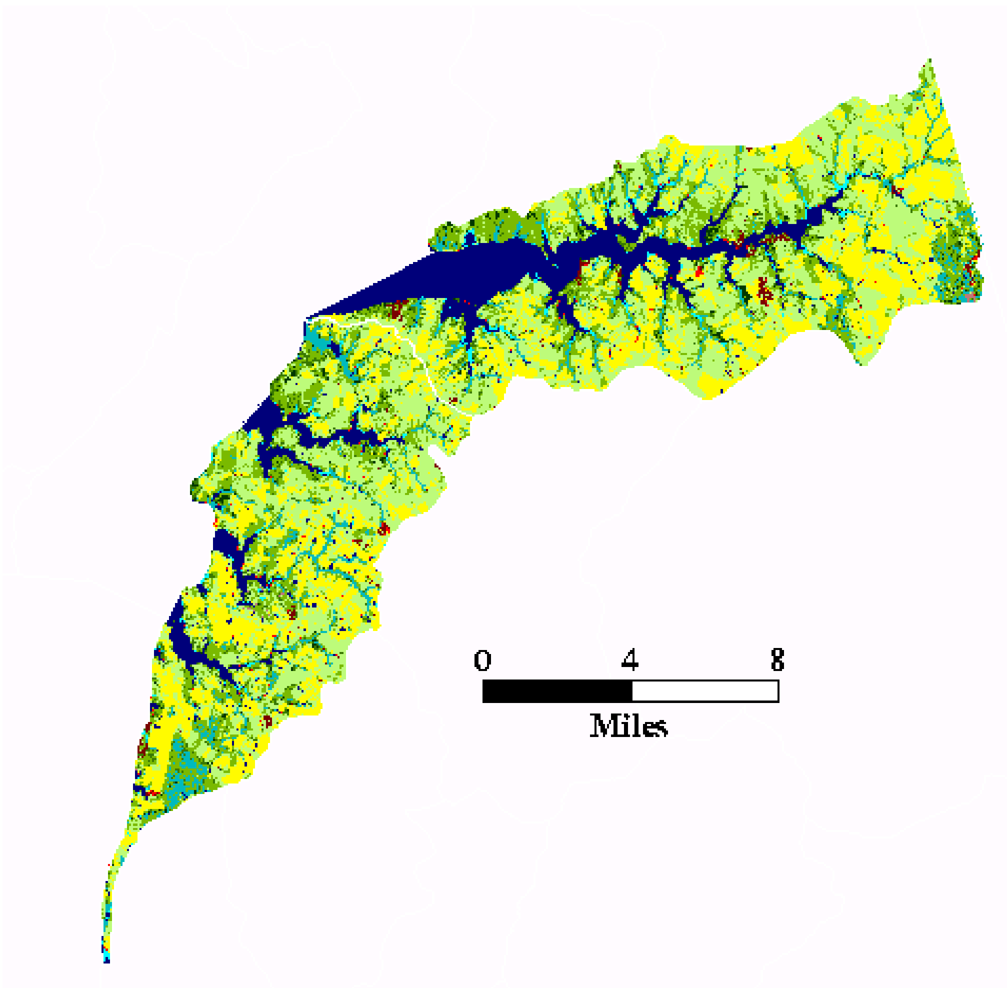
Herpetofauna Present

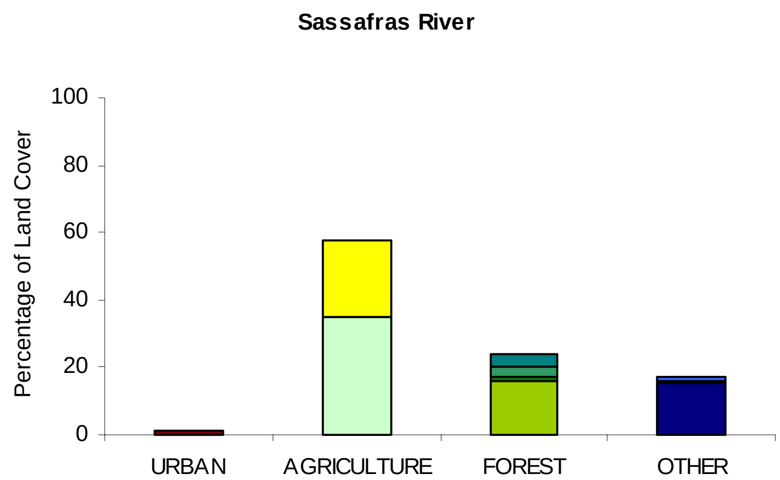
AMERICAN TOAD
BULLFROG
COMMON SNAPPING TURTLE
EASTERN BOX TURTLE
GREEN FROG
NORTHERN TWO-LINED SALAMANDER
NORTHERN WATER SNAKE
PICKEREL FROG
ROUGH GREEN SNAKE
SOUTHERN LEOPARD FROG

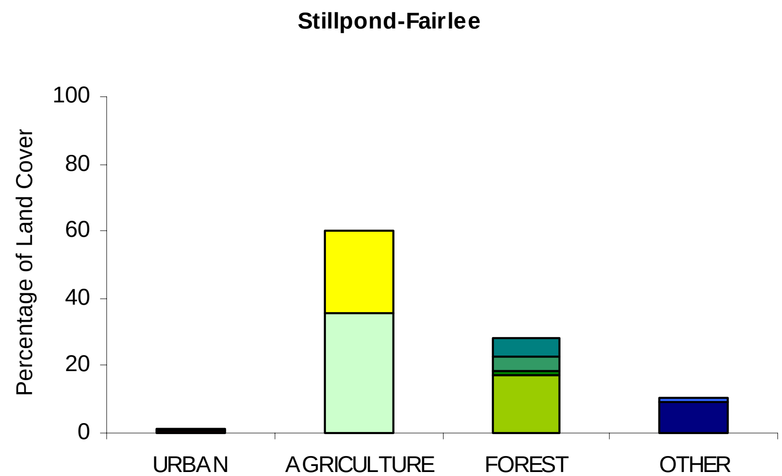
Sassafras River/ Stillpond-Fairlee watersheds
MBSS 2001



Sassafras River/Stillpond-Fairlee







Sassafras River/Stillpond-Fairlee

Site Information

Site	Stream Name	12-Digit Subwatershed Code	8-digit Watershed	Basin	County	Date Sampled Spring	Date Sampled Summer	Order	Catchment Area (acres)
SASS-102-R-2001	SWANTOWN CR	021306100357	Sassafras River	ELK RIVER	Kent	26-Mar-01	9-Jul-01	1	124
SASS-104-R-2001	WOODLAND CR UT1	021306100355	Sassafras River	ELK RIVER	Kent	26-Mar-01	2-Jul-01	1	1931
SASS-120-R-2001	DUFFY CR	021306100357	Sassafras River	ELK RIVER	Cecil	28-Mar-01	31-Jul-01	1	1117
SASS-205-R-2001	HERRING BR	021306100358	Sassafras River	ELK RIVER	Kent	26-Mar-01	9-Jul-01	2	1869
STIL-103-R-2001	BIG MARSH UT1	021306110352	Stilpond-Fairlee	ELK RIVER	Kent	26-Mar-01	2-Jul-01	1	825
STIL-109-R-2001	FAIRLEE CR UT2	021306110349	Stilpond-Fairlee	ELK RIVER	Kent	27-Mar-01	12-Jul-01	1	964
STIL-114-R-2001	FAIRLEE CR UT1 UT1	021306110349	Stilpond-Fairlee	ELK RIVER	Kent	27-Mar-01	12-Jul-01	1	218
STIL-119-R-2001	MILL CR UT1	021306110351	Stilpond-Fairlee	ELK RIVER	Kent	28-Mar-01	23-Jul-01	1	670
STIL-207-R-2001	FAIRLEE CR UT1 UT2	021306110349	Stilpond-Fairlee	ELK RIVER	Kent	27-Mar-01	3-Jul-01	2	1347

Indicator Information

Site	FIBI	BIBI	PHI	Brook Trout Present	Black Water Stream
SASS-102-R-2001	NR	2.43	13.68	0	0
SASS-104-R-2001	4.00	2.43	92.62	0	0
SASS-120-R-2001	3.75	1.86	78.89	0	0
SASS-205-R-2001	4.25	3.00	88.32	0	1
STIL-103-R-2001	1.25	1.86	9.92	0	0
STIL-109-R-2001	3.50	2.43	72.86	0	0
STIL-114-R-2001	NR	2.43	45.80	0	0
STIL-119-R-2001	3.50	2.14	49.36	0	0
STIL-207-R-2001	3.00	3.57	69.48	0	0

Catchment Land Use Information

Site	Percent Urban	Percent Agriculture	Percent Forest	Percent Other	Percent Impervious Surface
SASS-102-R-2001	1.02	81.22	16.75	1.02	0.63
SASS-104-R-2001	0.67	85.21	12.77	1.36	0.21
SASS-120-R-2001	0.23	83.52	16.25	0.00	0.07
SASS-205-R-2001	0.67	62.78	35.54	1.01	0.23
STIL-103-R-2001	0.80	80.82	16.63	1.75	0.37
STIL-109-R-2001	1.31	73.09	23.78	1.83	0.49
STIL-114-R-2001	1.17	84.69	12.97	1.17	0.80
STIL-119-R-2001	1.60	78.06	18.41	1.93	0.52
STIL-207-R-2001	0.47	80.98	17.38	1.17	0.25

Interpretation of Watershed Condition

- Most sites located in highly agricultural catchments
- Nitrogen and phosphorous values elevated at all sites
- Beaver activity in evidence at several streams
- Landfill across the stream from site 207

Sassafras River/Stillpond-Fairlee

Water Chemistry Information

Site	Closed pH	Specific Cond.	ANC (µeq/L)	Cl (mg/L)	Nitrate-N (mg/L)	SO4 (mg/L)	T-P (mg/L)	Ortho-P (mg/L)	Nitrite (mg/L)	Ammonia (mg/L)	T-N (mg/L)	DOC (mg/L)	DO (mg/L)	Turbidity (mg/L)
SASS-102-R-2001	6.46	155.1	228.2	27.650	0.098	7.286	0.1522	0.011	0.0073	0.229	1.349	23.874	1.6	4.2
SASS-104-R-2001	7.12	228.0	583.7	16.196	8.399	13.017	0.0484	0.009	0.0195	0.041	8.450	4.008	8.6	3.1
SASS-120-R-2001	6.59	166.3	242.0	16.002	3.092	20.140	0.1039	0.001	0.0125	0.107	3.790	0.835	6.2	13.6
SASS-205-R-2001	6.53	79.8	197.6	7.547	0.649	6.861	0.0454	0.006	0.0061	0.048	1.019	12.957	6.9	7.8
STIL-103-R-2001	6.64	124.9	463.2	11.648	0.961	8.415	0.1668	0.001	0.0135	0.634	1.845	4.027	4.5	32
STIL-109-R-2001	6.41	128.2	248.3	13.510	1.422	11.608	0.1975	0.003	0.0131	0.069	1.908	3.409	5.1	24.4
STIL-114-R-2001	6.63	182.7	319.9	18.750	2.130	21.848	0.1131	0.001	0.0096	0.274	3.084	4.236	6.2	15.4
STIL-119-R-2001	5.87	135.5	65.8	11.658	2.398	21.993	0.0954	0.003	0.0041	0.093	3.012	2.003	6.3	19.8
STIL-207-R-2001	6.58	163.3	173.9	19.099	3.378	13.570	0.0870	0.005	0.0149	0.091	4.199	2.649	6.9	18.4

Physical Habitat Condition

Site	Riparian Buffer Width Left	Riparian Buffer Width Right	Adjacent Cover Left	Adjacent Cover Right	Instream Habitat Structure	Epifaunal Substrate	Velocity/ Depth Diversity	Pool/ Glide/ Eddy Quality	Extent of Pools (m)	Riffle/ Run Quality	Extent of Riffles (m)	Embed-dedness	Shading	Trash Rating	Maximum Depth (cm)
SASS-102-R-2001	1	1	CP	CP	11	14	2	8	75	0	0	100	100	11	28
SASS-104-R-2001	50	50	FR	OF	16	13	15	16	70	16	20	100	25	18	130
SASS-120-R-2001	40	50	CP	FR	10	7	11	15	75	12	14	100	65	19	125
SASS-205-R-2001	18	50	CP	FR	11	13	14	15	38	14	42	40	80	19	89
STIL-103-R-2001	50	50	FR	FR	6	3	3	6	58	7	17	100	85	16	30
STIL-109-R-2001	40	50	CP	FR	15	13	11	13	65	12	10	100	65	17	75
STIL-114-R-2001	50	50	FR	FR	8	6	8	12	52	7	23	100	80	19	70
STIL-119-R-2001	50	50	FR	FR	8	6	8	14	75	0	0	100	82	14	88
STIL-207-R-2001	50	50	FR	FR	10	7	15	13	62	16	27	100	85	15	80

Physical Habitat Modifications

Site	Buffer Breaks?	Surface Mine?	Landfill?	Channelization?	Erosion Severity Left	Erosion Severity Right	Bar Formation
SASS-102-R-2001	N	N	N	Y	None	None	None
SASS-104-R-2001	N	N	N	N	None	None	None
SASS-120-R-2001	N	N	N	N	None	None	None
SASS-205-R-2001	N	N	N	N	Moderate	Moderate	Moderate
STIL-103-R-2001	N	N	N	N	Mild	Mild	Moderate
STIL-109-R-2001	N	N	N	N	Mild	Mild	None
STIL-114-R-2001	N	N	N	N	Mild	Mild	Moderate
STIL-119-R-2001	N	N	N	N	Mild	Mild	None
STIL-207-R-2001	N	N	N	N	Severe	Severe	None

Sassafras River/Stillpond-Fairlee

Stream Waders Data

Site	8-Digit Watershed	12-Digit Subwatershed	Stream name	Benthic IBI
0356-1	Sassafras River	021306100356	HALL CR	2.43
0357-3	Sassafras River	021306100357	JACOBS CR	2.14
0353-1	Sassafras River	021306100353	LLOYD CR UT	1.57
0357-4	Sassafras River	021306100357	JACOBS CR	1.86
0355-1	Sassafras River	021306100355	DYER CR	1.57
0355-2	Sassafras River	021306100355	WOODLAND CR	1.29
0357-1	Sassafras River	021306100357	MILL POND CR UT	1.86
0357-2	Sassafras River	021306100357	SWANTOWN CR UT	1.29
0356-3	Sassafras River	021306100356	COX CR	1.57
0356-4	Sassafras River	021306100356	COX CR	1.57
0357-5	Sassafras River	021306100357	DUFFY CR	1.86
0352-1	Stillpond-Fairlee	021306110352	STILL POND CR UT	1.86
0350-2	Stillpond-Fairlee	021306110350	TIMS CR	3.29
0351-92	Stillpond-Fairlee	021306110351	MILL CR	2.14
0351-2	Stillpond-Fairlee	021306110351	MILL CR	3.00
0351-5	Stillpond-Fairlee	021306110351	MILL CR UT	1.29
0351-94	Stillpond-Fairlee	021306110351	MILL CR	1.57
0348-1	Stillpond-Fairlee	021306110348		1.00
0351-4	Stillpond-Fairlee	021306110351	MILL CR UT	2.14
0348-91	Stillpond-Fairlee	021306110348	CHESAPEAKE BAY UT	1.29
0351-3	Stillpond-Fairlee	021306110351	MILL CR	3.00
0349-94	Stillpond-Fairlee	021306110349	FAIRLEE CR UT	1.29
0350-93	Stillpond-Fairlee	021306110350	MILL CR UT	2.14
0349-92	Stillpond-Fairlee	021306110349	FAIRLEE CR UT	1.57
0349-93	Stillpond-Fairlee	021306110349	FAIRLEE CR	1.57
0349-3	Stillpond-Fairlee	021306110349	FAIRLEE CR	2.43
0350-92	Stillpond-Fairlee	021306110350	TIMS CR	2.43
0350-3	Stillpond-Fairlee	021306110350	MILL CR UT	3.57
0349-2	Stillpond-Fairlee	021306110349	FAIRLEE CR UT	1.57
0349-1	Stillpond-Fairlee	021306110349	FAIRLEE CR UT	3.29
0350-91	Stillpond-Fairlee	021306110350	TIMS CR	2.14
0350-1	Stillpond-Fairlee	021306110350	TIMS CR	2.14
0349-91	Stillpond-Fairlee	021306110349	FAIRLEE CR UT	1.57

Sassafras River/Stillpond-Fairlee

Fish Species Present

AMERICAN EEL
BLACK CRAPPIE
BLUEGILL
BROWN BULLHEAD
CREEK CHUB
CREEK CHUBSUCKER
EASTERN MUDMINNOW
GOLDEN SHINER
GREEN SUNFISH
LARGEMOUTH BASS
LEAST BROOK LAMPREY
MOSQUITOFISH
REDFIN PICKEREL
TESSELLATED DARTER
WARMOUTH
YELLOW BULLHEAD

Exotic Plants Present

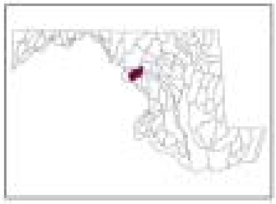
JAPANESE HONEYSUCKLE
MULTIFLORA ROSE
MILE-A-MINUTE
MICROSTEGIUM
PHRAGMITES
THISTLE

Benthic Taxa Present

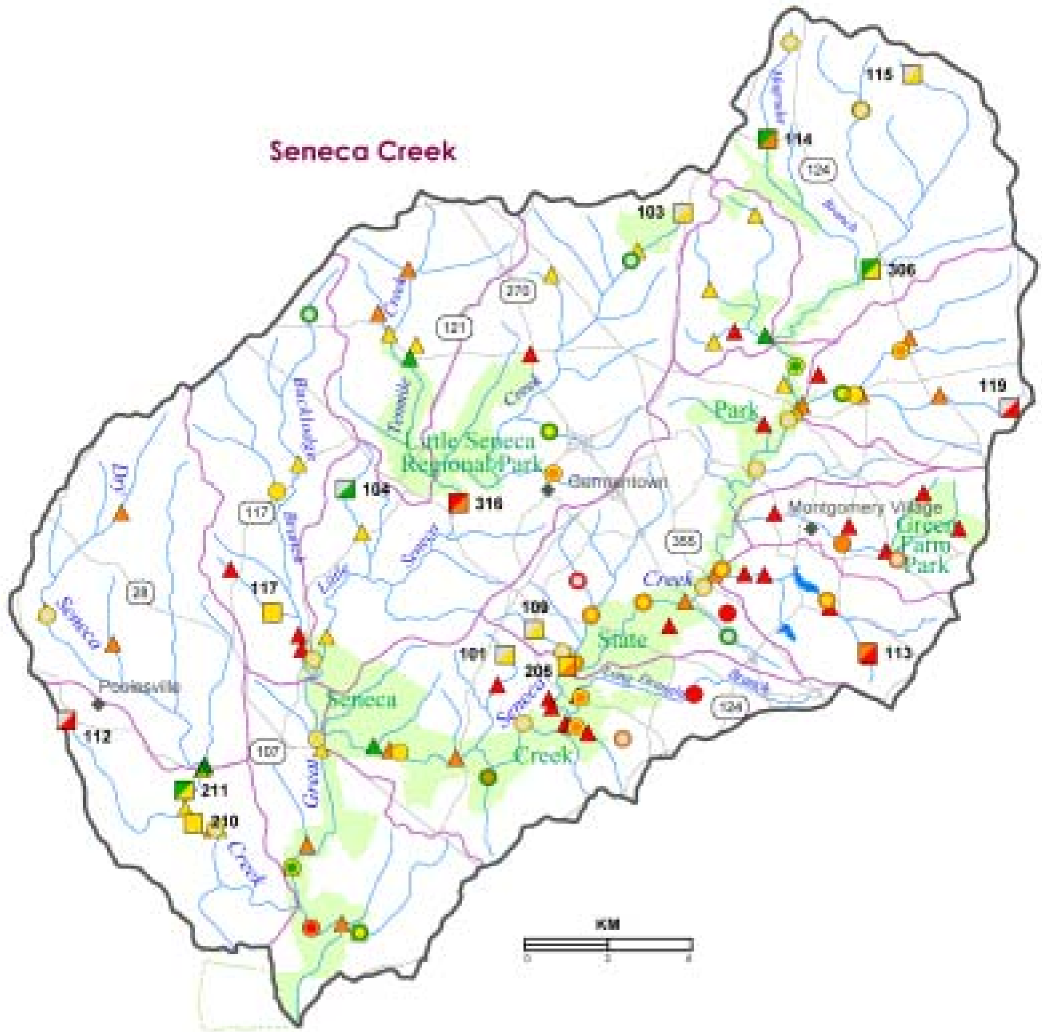
ABLABESMYIA
ALBOGLOSSIPHONIA
AMNICOLA
AMPHIPODA
ANCYRONYX
CAECIDOTEA
CAENIS
CALLIBAETIS
CALOPTERYX
CERATOPOGON
CHAETOCLADIUS
CHAULIODES
CHELIFERA
CHEUMATOPSYCHE
CHIRONOMIDAE
CHIRONOMINAE
CHIRONOMINI
CHRYSOPS
CLINOCERA
CNEPHIA
COENAGRIONIDAE
CONCHAPELOPIA
CORIXIDAE
CORYNONEURA
CRANGONYX
CRICOTOPUS
CRICOTOPUS/ORTHOCLADIUS
CRYPTOCHIRONOMUS
CURA
DICROTENDIPES
DIPLOCLADIUS
DIPTERA
DOLICHOPODIDAE
DUBIRAPHIA
DUGESIA
ENALLAGMA
ENCHYTRAEIDAE
EUKIEFFERIELLA
GAMMARUS
GORDIIDAE
HALIPLUS
HEXATOMA
HYALELLA
HYDROBAENUS
HYDROPORUS
IRONOQUIA
ISCHNURA
LEPIDOPTERA
LEPTOPHLEBIA
LEPTOPHLEBIIDAE
LIBELLULIDAE
LIMNODRILUS
LIMNOPHYES
LUMBRICULIDAE
LYPE
MACRONYCHUS
MENETUS
MICROPSECTRA
MICROTENDIPES
MOLOPHILUS
NAIDIDAE
NANOCLADIUS
NEURECLIPSIS
NOTONECTA
ORMOSIA
ORTHOCLADIINAE
OULIMNIUS
PACHDIPLAX
PARAKIEFFERIELLA
PARAMERINA
PARAMETRIOCNEMUS
PARATANYTARSUS
PARATENDIPES
PELTODYTES
PHAENOPSECTRA
PHYSELLA
PLANORBELLA
POLYCENTROPODIDAE
POLYPEDILUM
PROBEZZIA
PROCLADIUS
PROSIMULIUM
PSECTROCLADIUS
PSEUDOLIMNOPHILA
RHANTUS
RHEOCRICOTOPUS
RHEOTANYTARSUS
SIALIS
SIMULIUM
SPHAERIUM
STEGOPTERNA
STENOCHIRONOMUS
STYGONECTES
SYMPOSIOCLADIUS
SYNURELLA
TANYPODINAE
TANYTARSINI
TANYTARSUS
THIENEMANNIELLA
THIENEMANNIMYIA GROUP
TIPULA
TIPULIDAE
TRIBELOS
TRICHOCORIXA
TUBIFICIDAE
XYLOTOPUS
ZAVRELIMYIA

Herpetofauna Present

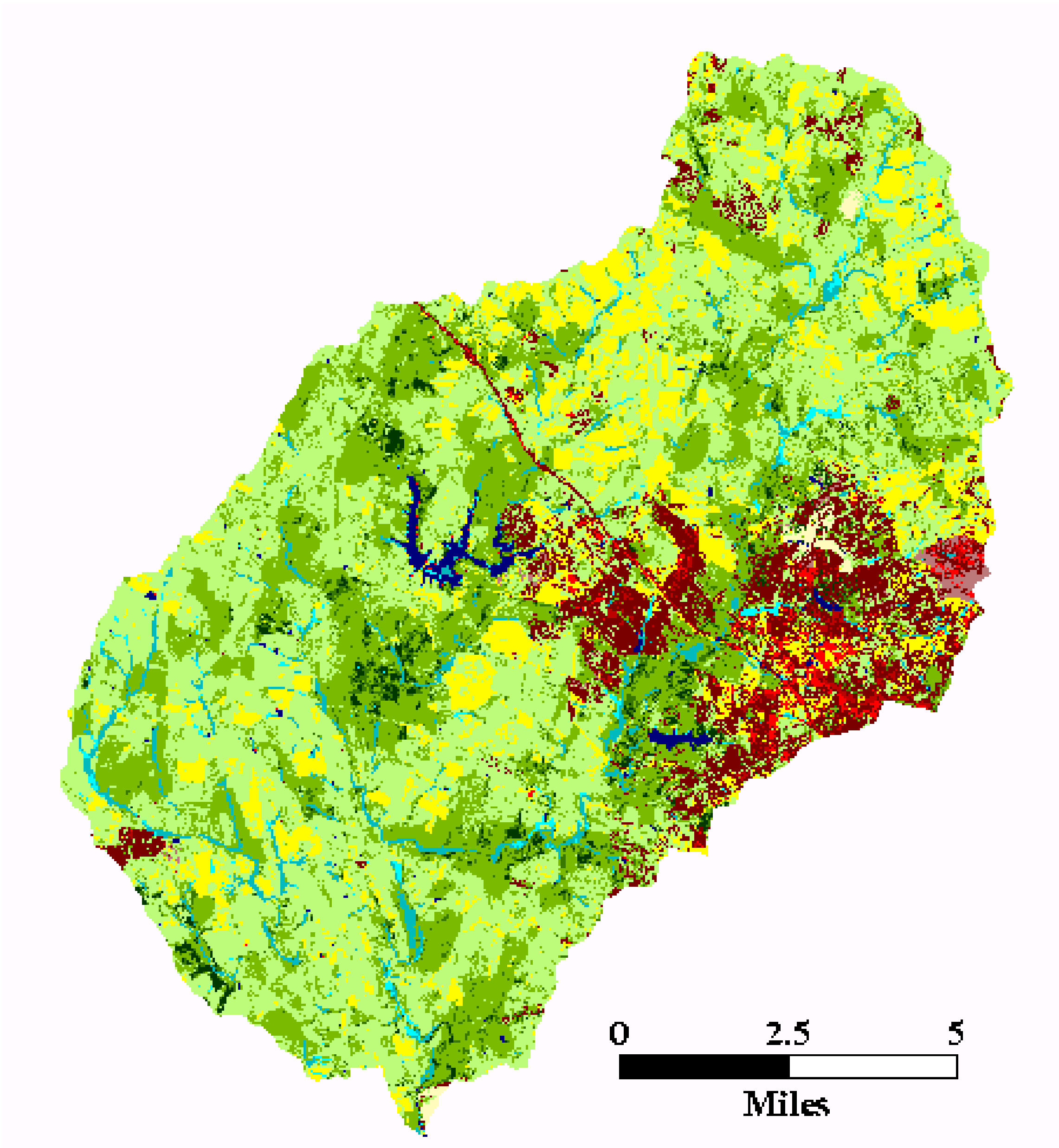
BULLFROG
COMMON MUSK TURTLE
COMMON SNAPPING TURTLE
EASTERN BOX TURTLE
FOWLER'S TOAD
GREEN FROG
NORTHERN TWO-LINED SALAMANDER
NORTHERN WATER SNAKE
PICKEREL FROG
SOUTHERN LEOPARD FROG

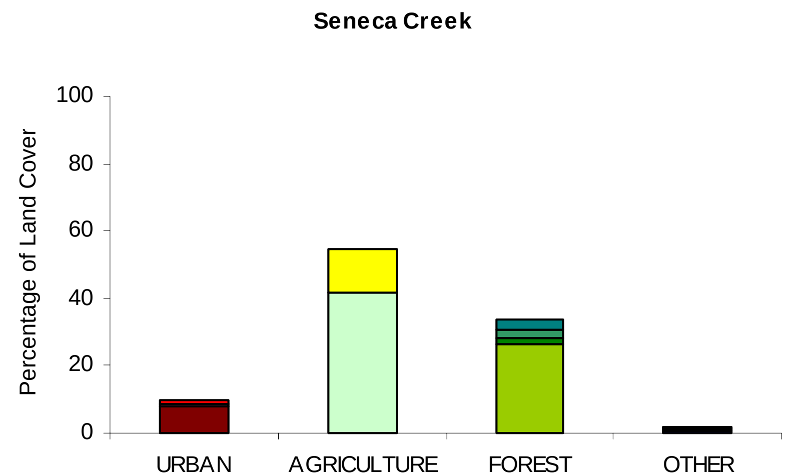


Seneca Creek watershed
MBSS 2001



Seneca Creek





Seneca Creek

Site Information

Site	Stream Name	12-Digit Subwatershed Code	8-digit Watershed	Basin	County	Date Sampled Spring	Date Sampled Summer	Order	Catchment Area (acres)
SENE-101-R-2001	GREAT SENECA CR UT3	021402080857	Seneca CR	WASHINGTON METROPOLITAN	Montgomery	19-Mar-01	11-Jul-01	1	103
SENE-103-R-2001	LITTLE SENECA CR	021402080859	Seneca CR	WASHINGTON METROPOLITAN	Montgomery	19-Mar-01	11-Jul-01	1	122
SENE-104-R-2001	LITTLE SENECA CR UT3	021402080859	Seneca CR	WASHINGTON METROPOLITAN	Montgomery	20-Mar-01	9-Jul-01	1	210
SENE-109-R-2001	GUNNERS BRANCH UT1	021402080860	Seneca CR	WASHINGTON METROPOLITAN	Montgomery	20-Mar-01	10-Jul-01	1	222
SENE-112-R-2001	RUSSEL BR	021402080855	Seneca CR	WASHINGTON METROPOLITAN	Montgomery	20-Mar-01	9-Jul-01	1	76
SENE-113-R-2001	WHETSTONE RUN	021402080862	Seneca CR	WASHINGTON METROPOLITAN	Montgomery	19-Mar-01	10-Jul-01	1	375
SENE-114-R-2001	MAGRUDER BR	021402080866	Seneca CR	WASHINGTON METROPOLITAN	Montgomery	19-Mar-01	10-Jul-01	1	684
SENE-115-R-2001	GREAT SENECA CR	021402080866	Seneca CR	WASHINGTON METROPOLITAN	Montgomery	19-Mar-01	10-Jul-01	1	87
SENE-117-R-2001	BUCKLODGE BR UT1	021402080858	Seneca CR	WASHINGTON METROPOLITAN	Montgomery	20-Mar-01	9-Jul-01	1	456
SENE-119-R-2001	GOSHEN BR UT1 UT2	021402080864	Seneca CR	WASHINGTON METROPOLITAN	Montgomery	19-Mar-01	7-Aug-01	1	76
SENE-205-R-2001	GREAT SENECA CR	021402080860	Seneca CR	WASHINGTON METROPOLITAN	Montgomery	19-Mar-01	8-Aug-01	2	31254
SENE-210-R-2001	DRY SENECA CR	021402080855	Seneca CR	WASHINGTON METROPOLITAN	Montgomery	20-Mar-01	7-Aug-01	2	10214
SENE-211-R-2001	DRY SENECA CR	021402080855	Seneca CR	WASHINGTON METROPOLITAN	Montgomery	20-Mar-01	8-Aug-01	2	8127
SENE-306-R-2001	GREAT SENECA CR	021402080866	Seneca CR	WASHINGTON METROPOLITAN	Montgomery	19-Mar-01	2-Aug-01	3	5581
SENE-316-R-2001	LITTLE SENECA CR	021402080859	Seneca CR	WASHINGTON METROPOLITAN	Montgomery	19-Mar-01	7-Aug-01	3	13519

Indicator Information

Site	FIBI	BIBI	PHI	Brook Trout Present	Black Water Stream
SENE-101-R-2001	NR	3.22	17.05	0	0
SENE-103-R-2001	NR	3.67	62.85	0	0
SENE-104-R-2001	NR	4.11	55.95	0	0
SENE-109-R-2001	NR	3.00	51.38	0	0
SENE-112-R-2001	NR	1.44	16.20	0	0
SENE-113-R-2001	2.11	1.67	49.33	0	0
SENE-114-R-2001	4.11	2.56	87.86	0	0
SENE-115-R-2001	NR	3.44	5.25	0	0
SENE-117-R-2001	3.00	3.44	51.38	0	0
SENE-119-R-2001	NS	1.44	NS	NS	NS
SENE-205-R-2001	3.89	2.56	92.05	0	0
SENE-210-R-2001	3.89	3.67	31.79	0	0
SENE-211-R-2001	4.11	3.00	86.72	0	0
SENE-306-R-2001	4.11	3.00	76.88	0	0
SENE-316-R-2001	1.44	2.11	55.45	0	0

Catchment Land Use Information

Site	Percent Urban	Percent Agriculture	Percent Forest	Percent Other	Percent Impervious Surface
SENE-101-R-2001	0.00	83.18	16.82	0.00	0.00
SENE-103-R-2001	1.55	87.63	10.82	0.00	0.39
SENE-104-R-2001	0.00	63.60	36.40	0.00	0.00
SENE-109-R-2001	5.94	74.68	19.38	0.00	1.56
SENE-112-R-2001	46.91	44.03	9.05	0.00	12.14
SENE-113-R-2001	51.30	16.99	31.20	0.50	18.21
SENE-114-R-2001	13.11	60.30	26.41	0.18	4.09
SENE-115-R-2001	0.00	97.11	2.89	0.00	0.00
SENE-117-R-2001	0.14	89.46	8.68	1.72	0.10
SENE-119-R-2001	4.17	84.58	9.17	2.08	1.04
SENE-205-R-2001	17.52	51.69	28.54	2.25	5.77
SENE-210-R-2001	1.82	65.22	31.53	1.43	0.51
SENE-211-R-2001	1.64	65.83	30.95	1.59	0.46
SENE-306-R-2001	3.59	70.67	24.32	1.41	0.94
SENE-316-R-2001	5.24	56.46	34.33	3.97	1.64

Seneca Creek

Interpretation of Watershed Condition

- Several sites in highly urbanized catchments; several others in highly agricultural catchments
- Chloride, nitrogen, and phosphorous levels elevated at nearly all sites
- Several sites with high turbidity
- Several sites with no riparian buffer
- Paved driveway crosses the midpoint of site 103
- Site 109 is between two apartment complexes
- High pH at sites 210 and 211

Water Chemistry Information

Site	Closed pH	Specific Cond.	ANC (µeq/L)	Cl (mg/L)	Nitrate-N (mg/L)	SO4 (mg/L)	T-P (mg/L)	Ortho-P (mg/L)	Nitrite (mg/L)	Ammonia (mg/L)	T-N (mg/L)	DOC (mg/L)	DO (mg/L)	Turbidity (mg/L)
SENE-101-R-2001	6.76	325.3	358.3	52.126	8.587	4.187	0.0142	0.005	0.0056	0.005	8.588	1.180	7.9	1.7
SENE-103-R-2001	7.34	343.7	559.7	73.268	6.462	3.368	0.0175	0.003	0.0076	0.005	6.497	1.061	8.4	3
SENE-104-R-2001	7.08	73.8	172.3	6.978	1.705	2.665	0.0109	0.001	0.0020	0.004	1.775	0.959	9	12.4
SENE-109-R-2001	7.44	362.4	753.7	62.835	2.707	6.063	0.0097	0.001	0.0032	0.002	3.074	0.948	8.7	3.5
SENE-112-R-2001	8.58	915.8	2286.3	165.988	1.518	31.904	0.0297	0.019	0.0129	0.020	1.870	4.780	6.5	19.7
SENE-113-R-2001	6.86	304.9	731.1	45.993	3.765	7.814	0.0071	0.001	0.0030	0.007	4.124	1.145	7	1.2
SENE-114-R-2001	7.63	482.7	898.3	93.894	1.942	13.834	0.0074	0.001	0.0028	0.004	2.060	1.110	8.4	4.9
SENE-115-R-2001	6.41	78.8	159.6	7.980	2.453	2.366	0.0388	0.001	0.0013	0.038	2.614	0.713	8.7	6.8
SENE-117-R-2001	7.55	301.6	550.0	34.380	5.369	24.301	0.0210	0.011	0.0047	0.009	5.896	2.561	10	2
SENE-119-R-2001	6.88	501.1	593.3	113.322	0.147	11.648	0.0143	0.001	0.0012	0.020	0.313	3.248	NS	NS
SENE-205-R-2001	7.74	308.1	726.1	54.867	2.297	9.385	0.0217	0.003	0.0117	0.020	2.682	1.590	8.9	4.2
SENE-210-R-2001	9.42	299.6	846.4	36.096	2.262	17.177	0.0696	0.057	0.0712	0.095	2.718	3.647	7.6	2.6
SENE-211-R-2001	9.08	316.6	920.2	39.666	2.366	16.952	0.0946	0.082	0.0765	0.408	3.041	3.569	6.7	3.1
SENE-306-R-2001	7.42	144.2	369.7	17.505	3.238	4.390	0.0122	0.001	0.0060	0.013	3.266	1.044	8.3	8.6
SENE-316-R-2001	7.45	239.2	642.9	39.204	0.829	5.424	0.0129	0.001	0.0116	0.065	1.200	2.441	10.1	2.9

Seneca Creek

Physical Habitat Condition

Site	Riparian Buffer Width Left	Riparian Buffer Width Right	Adjacent Cover Left	Adjacent Cover Right	Instream Habitat Structure	Epifaunal Substrate	Velocity/ Depth Diversity	Pool/ Glide/ Eddy Quality	Extent of Pools (m)	Riffle/ Run Quality	Extent of Riffles (m)	Embedded-ness	Shading	Trash Rating	Maximum Depth (cm)
SENE-101-R-2001	50	50	FR	FR	9	14	6	4	20	7	60	10	92	12	16
SENE-103-R-2001	50	50	LN	LN	14	13	14	15	35	13	45	35	80	14	100
SENE-104-R-2001	50	50	FR	FR	10	10	8	6	30	6	50	25	94	19	24
SENE-109-R-2001	50	38	FR	PV	7	12	7	7	36	13	46	10	88	10	36
SENE-112-R-2001	0	0	PV	PV	11	5	6	10	70	3	5	65	95	15	40
SENE-113-R-2001	50	50	LN	LN	16	14	11	17	50	8	25	20	85	5	81
SENE-114-R-2001	38	50	HO	FR	14	15	13	13	43	14	35	10	86	15	56
SENE-115-R-2001	50	50	FR	OF	4	5	4	3	30	6	50	20	80	16	10
SENE-117-R-2001	5	0	CP	CP	13	14	9	6	40	10	40	20	72	16	21
SENE-119-R-2001	0	0	CP	CP	NS	NS	NS	NS	NS	NS	NS	NS	NS	16	NS
SENE-205-R-2001	50	50	FR	FR	16	12	13	15	69	14	6	25	60	16	168
SENE-210-R-2001	50	7	FR	CP	13	16	7	9	65	12	20	30	80	17	34
SENE-211-R-2001	50	50	FR	FR	17	16	13	17	70	11	12	25	75	17	68
SENE-306-R-2001	0	0	CP	CP	16	11	15	15	55	13	23	40	20	14	75
SENE-316-R-2001	50	50	FR	FR	15	14	10	15	75	0	0	30	65	17	67

Physical Habitat Modifications

Site	Buffer Breaks?	Surface Mine?	Landfill?	Channelization?	Erosion Severity Left	Erosion Severity Right	Bar Formation
SENE-101-R-2001	N	N	N	N	None	Mild	Minor
SENE-103-R-2001	N	N	N	Y	Moderate	Moderate	Minor
SENE-104-R-2001	N	N	N	N	Mild	Moderate	Severe
SENE-109-R-2001	N	N	N	N	None	Mild	Moderate
SENE-112-R-2001	N	N	N	Y	Mild	Mild	Moderate
SENE-113-R-2001	N	N	N	N	Moderate	Moderate	Minor
SENE-114-R-2001	N	N	N	N	Moderate	Moderate	Severe
SENE-115-R-2001	N	N	N	N	None	None	Minor
SENE-117-R-2001	Y	N	N	N	Moderate	Mild	Minor
SENE-119-R-2001	Y	N	N	N	NS	NS	NS
SENE-205-R-2001	N	N	N	Y	Mild	Severe	Moderate
SENE-210-R-2001	N	N	N	N	Moderate	Moderate	Minor
SENE-211-R-2001	N	N	N	N	Moderate	Mild	Moderate
SENE-306-R-2001	Y	N	N	N	Severe	Severe	Minor
SENE-316-R-2001	N	N	N	Y	Mild	Mild	Minor

Seneca Creek

Stream Waders Data

Site	8-Digit Watershed	12-Digit Subwatershed	Stream name	Benthic IBI
0855-3	Seneca Creek	021402080855	DRY SENECA CR	3.00
0863-1	Seneca Creek	021402080863	CABIN BR UT	1.29
0864-2	Seneca Creek	021402080864	GOSHEN BR UT	2.71
0859-1	Seneca Creek	021402080859	SENECA CR UT	3.57
0863-3	Seneca Creek	021402080863	CABIN BR UT	1.57
0864-1	Seneca Creek	021402080864	GOSHEN BR	2.71
0863-2	Seneca Creek	021402080863	CABIN BR	1.57
0862-1	Seneca Creek	021402080862		1.57
0864-3	Seneca Creek	021402080864	GOSHEN BR UT	2.43
0863-4	Seneca Creek	021402080863	CABIN BR UT	1.57
0862-2	Seneca Creek	021402080862		1.57
0864-5	Seneca Creek	021402080864	JENNY CR	1.86
0864-4	Seneca Creek	021402080864	GOSHEN BR	2.43
0860-1	Seneca Creek	021402080860	GREAT SENECA CR	3.00
0860-3	Seneca Creek	021402080860	GREAT SENECA CR UT	3.00
0863-5	Seneca Creek	021402080863	CABIN BR	1.57
0865-1	Seneca Creek	021402080865	GREAT SENECA CR	4.14
0862-3	Seneca Creek	021402080862		1.29
0860-2	Seneca Creek	021402080860	GREAT SENECA CR UT	1.29
0865-5	Seneca Creek	021402080865	GREAT SENECA CR UT	3.57
0862-4	Seneca Creek	021402080862		1.57
0865-3	Seneca Creek	021402080865	GREAT SENECA CR	1.57
0862-6	Seneca Creek	021402080862		2.14
0865-4	Seneca Creek	021402080865	GREAT SENECA CR	3.86
0865-2	Seneca Creek	021402080865	WILDCAT BR	3.86
0860-4	Seneca Creek	021402080860	GREAT SENECA CR UT	2.43
0860-5	Seneca Creek	021402080860		1.29
0859-2	Seneca Creek	021402080859	SENECA CR	3.00
0857-5	Seneca Creek	021402080857	GREAT SENECA CR UT	1.57
0857-6	Seneca Creek	021402080857	LONG DRAUGHT BR	1.57
0857-4	Seneca Creek	021402080857	GREAT SENECA CR UT	2.71
0857-1	Seneca Creek	021402080857	GREAT SENECA CR	1.29
0857-2	Seneca Creek	021402080857	GREAT SENECA CR	1.29
0854-1	Seneca Creek	021402080857	SENECA CR UT	3.00
0857-3	Seneca Creek	021402080857	GREAT SENECA CR	1.57
0859-3	Seneca Creek	021402080859	LITTLE SENECA CR	1.57
0857-7	Seneca Creek	021402080857	GREAT SENECA CR UT	1.57
0857-8	Seneca Creek	021402080857	GREAT SENECA CR	2.71
0861-4	Seneca Creek	021402080861		3.00
0861-5	Seneca Creek	021402080861	TEN MILE CR UT	4.43
0861-1	Seneca Creek	021402080861	TEN MILE CR UT	2.71
0857-10	Seneca Creek	021402080857	GREAT SENECA CR	2.43
0861-3	Seneca Creek	021402080861	TEN MILE CR UT	3.86
0861-2	Seneca Creek	021402080861	TEN MILE CR UT	2.71
0857-9	Seneca Creek	021402080857	GREAT SENECA CR UT	4.14
Site	**8-Digit Watershed**	**12-Digit Subwatershed**	**Stream name**	**Benthic IBI**
0859-4	Seneca Creek	021402080859	LITTLE SENECA CR UT	3.29
0854-2	Seneca Creek	021402080854	SENECA CR UT	3.57

Seneca Creek

0854-3	Seneca Creek	021402080854	SENECA CR	2.71
0859-5	Seneca Creek	021402080859	LITTLE SENECA CR	3.00
0855-1	Seneca Creek	021402080855	DRY SENECA CR	3.29
0854-5	Seneca Creek	021402080854	SENECA CR UT	2.14
0858-1	Seneca Creek	021402080858	BUCKLODGE BR UT	1.86
0858-3	Seneca Creek	021402080858	BUCKLODGE BR	3.00
0858-2	Seneca Creek	021402080858	BUCKLODGE BR	1.29
0854-4	Seneca Creek	021402080854	SENECA CR	2.71
0858-4	Seneca Creek	021402080858	BUCKLODGE BR UT	1.00
0855-5	Seneca Creek	021402080855	DRY SENECA CR	3.00
0855-2	Seneca Creek	021402080855	DRY SENECA CR	2.14
0856-2	Seneca Creek	021402080856	DRY SENECA CR UT	4.43
0856-1	Seneca Creek	021402080855	DRY SENECA CR	3.00
0855-4	Seneca Creek	021402080855	DRY SENECA CR	3.29
0856-3	Seneca Creek	021402080856	DRY SENECA CR	3.29
0856-5	Seneca Creek	021402080856	DRY SENECA CR	2.71
0856-4	Seneca Creek	021402080856	DRY SENECA CR UT	2.43

Seneca Creek

Fish Species Present

AMERICAN EEL
BLACK CRAPPIE
BLACKNOSE DACE
BLUEGILL
BLUNTNOSE MINNOW
CENTRAL STONEROLLER
COMMON SHINER
CREEK CHUB
CREEK CHUBSUCKER
CUTLIPS MINNOW
CYPRINID HYBRID
EASTERN SILVERY MINNOW
FALLFISH
FANTAIL DARTER
GOLDEN SHINER
GREEN SUNFISH
GREENSIDE DARTER
LARGEMOUTH BASS
LONGNOSE DACE
MOSQUITOFISH
MOTTLED SCULPIN
NORTHERN HOGSUCKER
POTOMAC SCULPIN
PUMPKINSEED
REDBREAST SUNFISH
RIVER CHUB
ROCK BASS
ROSYSIDE DACE
SILVERJAW MINNOW
SMALLMOUTH BASS
TESSELLATED DARTER
WHITE SUCKER
YELLOW BULLHEAD

Exotic Plants Present

JAPANESE HONEYSUCKLE
MULTIFLORA ROSE
MILE-A-MINUTE
MICROSTEGIUM
THISTLE

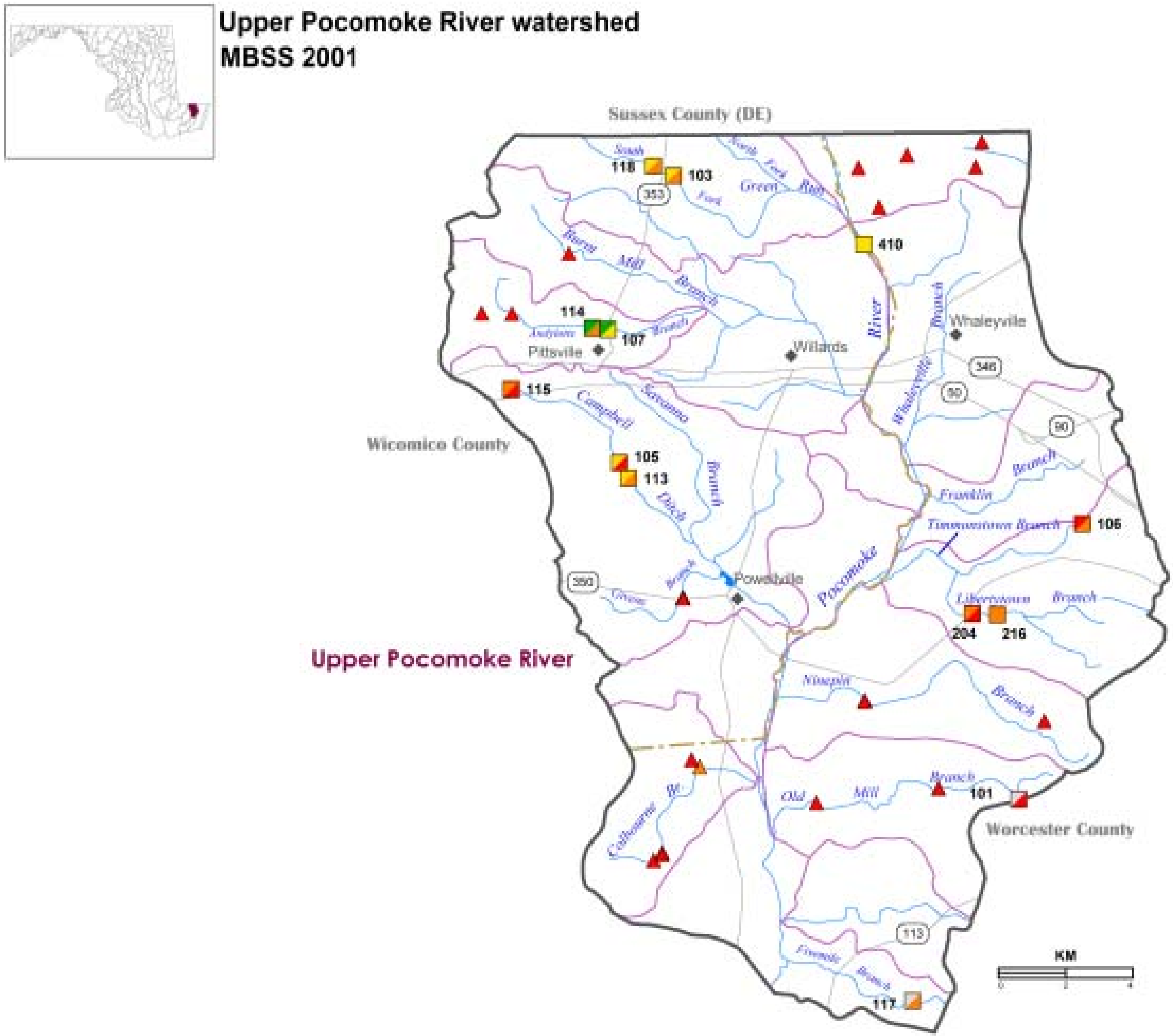
Benthic Taxa Present

ACERPENNA
AGABUS
ALLOCAPNIA
AMELETUS
AMPHINEMURA
ANTOCHA
ARGIA
BAETIDAE
BAETIS
BRILLIA
CAECIDOTEA
CAENIS
CALOPTERYX
CERATOPOGON
CERATOPOGONIDAE
CHAETOCLADIUS
CHEUMATOPSYCHE
CHIRONOMINAE
CHRYSOGASTER
CHRYSOPS
CLINOCERA
CORBICULA
CORYNONEURA
CRANGONYX
CRICOTOPUS
CRICOTOPUS/ORTHOCLADIUS
CULICOIDES
CURA
DIAMESA
DIAMESINAE
DIPLECTRONA
DUGESIA
DYTISCIDAE
ECCOPTURA
EPHEMERELLA
EUKIEFFERIELLA
EURYLOPHELLA
FERRISSIA
GOMPHIDAE
GORDIIDAE
HAGENIUS
HELICHUS
HEMERODROMIA
HETEROTRISSOCLADIUS
HEXATOMA
HYDROBAENUS
HYDROPORUS
HYDROPSYCHE
HYDROPSYCHIDAE
HYDROPTILA
IRONOQUIA
ISONYCHIA
KRENOPELOPIA
LEUCTRIDAE
LIMNEPHILIDAE
LIMNOPHYES
LUMBRICULIDAE
LYMNAEIDAE
MACRONYCHUS
MEROPELOPIA
MICROPSECTRA
MICROTENDIPES
MOLANNODES
NAIDIDAE
NANOCLADIUS
NEMOURIDAE
NEOPHYLAX
NIGRONIA
OPTIOSERVUS
ORTHOCLADIINAE
ORTHOCLADIINAE A
OULIMNIUS
PARALEPTOPHLEBIA
PARAMETRIOCNEMUS
PARATANYTARSUS
PERLODIDAE
PHAENOPSECTRA
PHYSELLA
PLANORBELLA
POLYPEDILUM
POTTHASTIA
PROBEZZIA
PRODIAMESA
PROSIMULIUM
PROSTOIA
PSEPHENUS
PSEUDOLIMNOPHILA
PYCNOPSYCHE
RHEOCRICOTOPUS
RHEOTANYTARSUS
RHYACOPHILA
SIALIS
SIMULIIDAE
SIMULIUM
SPHAERIIDAE
SPIROSPERMA
STEGOPTERNA
STENACRON
STENELMIS
STENONEMA
STICTOCHIRONOMUS
STROPHOPTERYX
SYMPOSIOCLADIUS
SYMPOTTHASTIA
TANYPODINAE
TANYTARSINI
TANYTARSUS
THIENEMANNIELLA
THIENEMANNIMYIA GROUP
TIPULA
TIPULIDAE
TRISSOPELOPIA
TUBIFICIDAE
TVETENIA

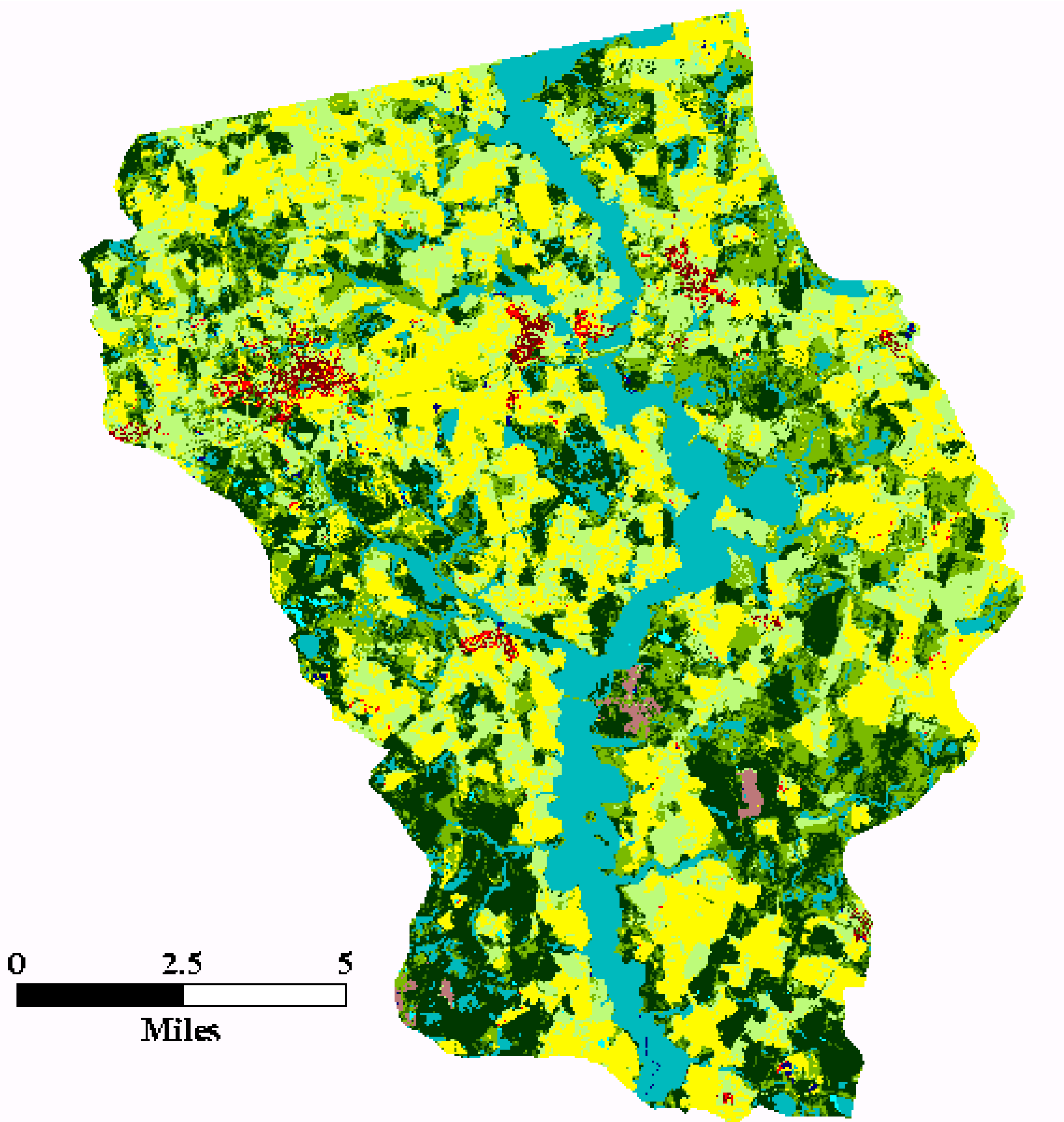
Herpetofauna Present

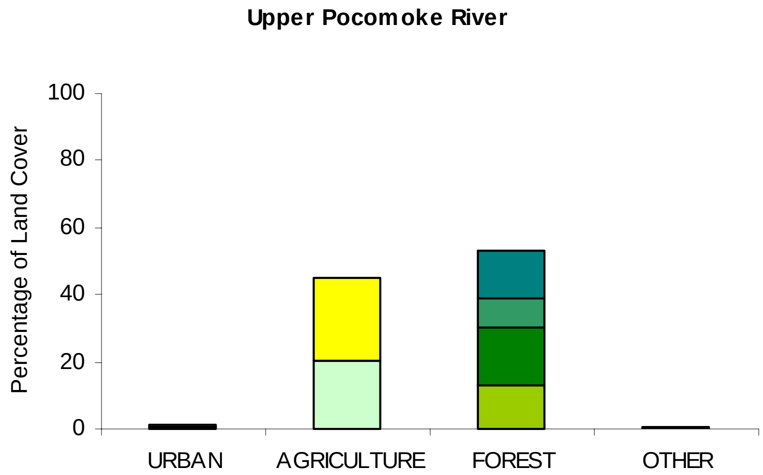
BULLFROG
EASTERN BOX TURTLE
FOWLER'S TOAD
GREEN FROG
NORTHERN DUSKY SALAMANDER
NORTHERN SPRING SALAMANDER
NORTHERN TWO-LINED SALAMANDER
NORTHERN WATER SNAKE
PICKEREL FROG
RED SALAMANDER

Upper Pocomoke River watershed
MBSS 2001



Upper Pocomoke River





Upper Pocomoke River

Site Information

Site	Stream Name	12-Digit Subwatershed Code	8-digit Watershed	Basin	County	Date Sampled Spring	Date Sampled Summer	Order	Catchment Area (acres)
UPPC-101-R-2001	OLD MILL BR	021302030643	Upper Pocomoke River	POCOMOKE RIVER	Worcester	13-Mar-01	13-Jun-01	1	66
UPPC-103-R-2001	SOUTH FORK GREEN RUN	021302030655	Upper Pocomoke River	POCOMOKE RIVER	Wicomico	12-Mar-01	12-Jun-01	1	2269
UPPC-105-R-2001	CAMPBELL DITCH	021302030648	Upper Pocomoke River	POCOMOKE RIVER	Wicomico	13-Mar-01	26-Jul-01	1	2758
UPPC-106-R-2001	TIMMONSTOWN BR	021302030646	Upper Pocomoke River	POCOMOKE RIVER	Worcester	15-Mar-01	11-Jun-01	1	895
UPPC-107-R-2001	AYDYLOTTE BR	021302030653	Upper Pocomoke River	POCOMOKE RIVER	Wicomico	06-Mar-01	12-Jun-01	1	3093
UPPC-113-R-2001	CAMPBELL DITCH	021302030648	Upper Pocomoke River	POCOMOKE RIVER	Wicomico	13-Mar-01	26-Jul-01	1	2893
UPPC-114-R-2001	AYDYLOTTE BR	021302030653	Upper Pocomoke River	POCOMOKE RIVER	Wicomico	06-Mar-01	12-Jun-01	1	2904
UPPC-115-R-2001	CAMPBELL DITCH	021302030648	Upper Pocomoke River	POCOMOKE RIVER	Wicomico	08-Mar-01	23-Aug-01	1	500
UPPC-117-R-2001	FIVEMILE BR	021302030640	Upper Pocomoke River	POCOMOKE RIVER	Worcester	14-Mar-01	13-Jun-01	1	314
UPPC-118-R-2001	SOUTH FORK GREEN RUN	021302030655	Upper Pocomoke River	POCOMOKE RIVER	Wicomico	15-Mar-01	19-Jun-01	1	1522
UPPC-204-R-2001	LiBERTYTOWN BR	021302030646	Upper Pocomoke River	POCOMOKE RIVER	Worcester	15-Mar-01	24-Jul-01	2	4057
UPPC-216-R-2001	LIBERTYTOWN BR	021302030646	Upper Pocomoke River	POCOMOKE RIVER	Worcester	15-Mar-01	24-Jul-01	2	3670
UPPC-410-R-2001	POCOMOKE R	021302030651	Upper Pocomoke River	POCOMOKE RIVER	Wicomico	13-Mar-01	23-Aug-01	4	33904

Indicator Information

Site	FIBI	BIBI	PHI	Brook Trout Present	Black Water Stream
UPPC-101-R-2001	NS	1.29	NS	NS	NS
UPPC-103-R-2001	3.50	2.71	62.84	0	0
UPPC-105-R-2001	3.25	1.57	27.66	0	0
UPPC-106-R-2001	1.50	2.14	12.91	0	0
UPPC-107-R-2001	4.50	3.29	93.67	0	1
UPPC-113-R-2001	3.00	2.43	25.93	0	0
UPPC-114-R-2001	4.00	2.43	49.64	0	1
UPPC-115-R-2001	2.50	1.57	21.00	0	0
UPPC-117-R-2001	NR	2.71	4.41	0	1
UPPC-118-R-2001	3.50	2.43	66.85	0	1
UPPC-204-R-2001	2.50	1.86	77.96	0	0
UPPC-216-R-2001	2.00	2.14	30.61	0	0
UPPC-410-R-2001	3.00	3.57	81.17	0	1

Catchment Land Use Information

Site	Percent Urban	Percent Agriculture	Percent Forest	Percent Other	Percent Impervious Surface
UPPC-101-R-2001	0.00	0.97	99.03	0.00	0.00
UPPC-103-R-2001	0.01	65.74	33.83	0.42	0.00
UPPC-105-R-2001	3.53	37.42	56.82	2.23	1.63
UPPC-106-R-2001	0.32	87.01	12.64	0.04	0.18
UPPC-107-R-2001	5.12	52.41	42.02	0.46	2.14
UPPC-113-R-2001	3.40	37.73	56.74	2.13	1.57
UPPC-114-R-2001	4.23	53.35	41.93	0.49	1.90
UPPC-115-R-2001	7.56	70.09	22.36	0.00	2.73
UPPC-117-R-2001	0.00	4.48	91.34	4.18	0.00
UPPC-118-R-2001	0.00	59.74	39.74	0.52	0.00
UPPC-204-R-2001	0.60	48.02	51.28	0.10	0.40
UPPC-216-R-2001	0.67	51.87	47.35	0.11	0.45
UPPC-410-R-2001	0.20	51.31	47.28	1.22	0.09

Interpretation of Watershed Condition

- Low pH and ANC values, combined with high DOC, low DO, and no riffles may be indicative of natural, blackwater conditions
- Nitrogen and phosphorus values elevated at nearly all sites
- No riparian buffer at several sites
- Channelization a problem at most sites
- Chicken farm adjacent to site 114
- Most streams are very small with muddy bottoms and a lot of algae

Upper Pocomoke River

Water Chemistry Information

Site	Closed pH	Specific Cond.	ANC (µeq/L)	Cl (mg/L)	Nitrate-N (mg/L)	SO4 (mg/L)	T-P (mg/L)	Ortho-P (mg/L)	Nitrite (mg/L)	Ammonia (mg/L)	T-N (mg/L)	DOC (mg/L)	DO (mg/L)	Turbidity (mg/L)
UPPC-101-R-2001	4.37	75.7	-43.2	10.133	0.097	7.351	0.0102	0.001	0.0035	0.018	0.308	15.099	NS	NS
UPPC-103-R-2001	7.05	148.8	209.6	13.748	3.477	13.636	0.0298	0.003	0.0099	0.014	4.083	7.581	8.2	7.4
UPPC-105-R-2001	6.64	160.1	306.9	19.158	1.455	15.057	0.0809	0.013	0.0096	0.029	2.125	14.498	1.8	11
UPPC-106-R-2001	6.40	271.3	391.2	30.420	1.259	44.701	0.0762	0.023	0.0114	0.045	1.883	10.147	4	22.9
UPPC-107-R-2001	6.50	191.6	191.0	18.785	4.932	20.295	0.0396	0.009	0.0097	0.154	6.002	10.683	8.9	9.5
UPPC-113-R-2001	6.50	127.4	245.5	15.169	0.727	11.997	0.0533	0.010	0.0067	0.022	1.230	14.005	1.8	11
UPPC-114-R-2001	6.54	192.0	181.5	18.948	5.099	20.384	0.0408	0.024	0.0079	0.146	6.138	10.842	9.2	6.4
UPPC-115-R-2001	7.36	292.9	449.8	29.839	5.318	28.450	0.1164	0.050	0.0178	0.026	6.277	18.065	4.6	24.8
UPPC-117-R-2001	5.00	131.1	29.0	18.434	0.098	16.598	0.0204	0.001	0.0058	0.028	0.645	32.876	1.3	76
UPPC-118-R-2001	6.34	140.3	154.2	15.105	2.799	13.200	0.0294	0.001	0.0051	0.014	3.663	13.527	5.5	7.5
UPPC-204-R-2001	6.60	160.6	387.4	16.097	0.671	20.011	0.1942	0.131	0.0056	0.036	1.403	16.927	4.7	8.4
UPPC-216-R-2001	6.61	161.7	339.3	16.588	0.784	20.946	0.1879	0.116	0.0078	0.027	1.452	14.526	4.7	8.4
UPPC-410-R-2001	6.26	132.9	191.7	12.439	2.630	13.684	0.0577	0.004	0.0109	0.235	3.400	10.694	5.2	14.5

Physical Habitat Condition

Site	Riparian Buffer Width Left	Riparian Buffer Width Right	Adjacent Cover Left	Adjacent Cover Right	Instream Habitat Structure	Epifaunal Substrate	Velocity/ Depth Diversity	Pool/ Glide/ Eddy Quality	Extent of Pools (m)	Riffle/ Run Quality	Extent of Riffles (m)	Embed-dedness	Shading	Trash Rating	Maximum Depth (cm)
UPPC-101-R-2001	50	50	FR	FR	NS	NS	NS	NS	NS	NS	NS	NS	NS	17	NS
UPPC-103-R-2001	0	0	CP	CP	14	5	9	14	75	0	0	100	20	16	58
UPPC-105-R-2001	50	50	FR	FR	10	10	5	10	75	0	0	100	93	16	43
UPPC-106-R-2001	0	50	CP	FR	7	4	5	6	75	6	2	100	90	17	22
UPPC-107-R-2001	0	0	PV	PV	18	15	15	17	45	12	35	80	15	15	110
UPPC-113-R-2001	50	50	FR	FR	8	11	5	10	75	0	0	100	80	18	45
UPPC-114-R-2001	50	0	FR	CP	17	12	5	10	75	11	30	100	25	19	44
UPPC-115-R-2001	0	0	PA	PA	9	5	4	9	75	0	0	100	10	16	40
UPPC-117-R-2001	13	50	LN	FR	3	4	4	6	30	0	0	100	95	6	21
UPPC-118-R-2001	0	0	CP	CP	16	11	9	14	75	0	0	100	10	16	54
UPPC-204-R-2001	6	50	CP	FR	17	11	6	17	75	0	0	100	85	15	100
UPPC-216-R-2001	50	50	FR	FR	8	5	8	6	75	0	0	100	85	18	76
UPPC-410-R-2001	50	50	FR	FR	13	13	10	15	75	0	0	100	93	18	123

Upper Pocomoke River

Physical Habitat Modifications

Site	Buffer Breaks?	Surface Mine?	Landfill?	Channelization?	Erosion Severity Left	Erosion Severity Right	Bar Formation
UPPC-101-R-2001	N	N	N	Y	NS	NS	NS
UPPC-103-R-2001	Y	N	N	Y	None	None	Moderate
UPPC-105-R-2001	N	N	N	N	None	None	Minor
UPPC-106-R-2001	Y	N	N	Y	Moderate	Mild	Moderate
UPPC-107-R-2001	Y	N	N	Y	None	None	Moderate
UPPC-113-R-2001	N	N	N	N	None	None	Minor
UPPC-114-R-2001	Y	N	N	Y	None	None	None
UPPC-115-R-2001	Y	N	N	N	Severe	Severe	None
UPPC-117-R-2001	N	N	Y	Y	None	None	None
UPPC-118-R-2001	Y	N	N	Y	None	None	None
UPPC-204-R-2001	N	N	N	Y	None	None	Severe
UPPC-216-R-2001	Y	N	N	Y	None	None	Severe
UPPC-410-R-2001	N	N	N	Y	Mild	Mild	None

Stream Waders Data

Site	8-Digit Watershed	12-Digit Subwatershed	Stream name	Benthic IBI
0648-3	Upper Pocomoke River	021302030648	GIVENS BR	1.86
0648-5	Upper Pocomoke River	021302030648	GIVENS BR	1.29
0641-4	Upper Pocomoke River	021302030641	DAVIS BR	1.57
0645-4	Upper Pocomoke River	021302030645	NINEPIN BR	1.29
0654-4	Upper Pocomoke River	021302030654	OLD LINE DITCH	1.57
0654-3	Upper Pocomoke River	021302030654	CAREYTOWN BR	1.57
0653-5	Upper Pocomoke River	021302030653	AYDYLOTTE BR UT	1.86
0653-4	Upper Pocomoke River	021302030653	AYDYLOTTE BR	1.00
0652-4	Upper Pocomoke River	021302030652		1.57
0653-1	Upper Pocomoke River	021302030653	AYDYLOTTE BR	2.43
0643-4	Upper Pocomoke River	021302030643	OLD MILL BR	1.57
0641-3	Upper Pocomoke River	021302030641	COLBOURNE BR	1.57
0641-1	Upper Pocomoke River	021302030641	COLBOURNE BR	1.57
0641-2	Upper Pocomoke River	021302030641	COLBOURNE BR	1.57
0648-1	Upper Pocomoke River	021302030648	GIVENS BR	1.57
0648-2	Upper Pocomoke River	021302030648	GIVENS BR	1.86
0648-4	Upper Pocomoke River	021302030648	GIVENS BR	1.57
0645-2	Upper Pocomoke River	021302030645	NINEPIN BR	1.86
0643-1	Upper Pocomoke River	021302030643	OLD MILL BR	1.29
0641-5	Upper Pocomoke River	021302030641	DAVID BR	2.43
0645-1	Upper Pocomoke River	021302030645	NINEPIN BR	1.00
0654-1	Upper Pocomoke River	021302030654	CAREYTOWN BR	1.57
0654-2	Upper Pocomoke River	021302030654	CAREYTOWN BR	1.29
0643-2	Upper Pocomoke River	021302030643	OLD MILL BR	1.00
0654-5	Upper Pocomoke River	021302030654	POCOMOKE R UT	1.29

Upper Pocomoke River

Fish Species Present

AMERICAN EEL
BANDED SUNFISH
BLACK CRAPPIE
BLUEGILL
BLUESPOTTED SUNFISH
BROWN BULLHEAD
CHAIN PICKEREL
CREEK CHUBSUCKER
EASTERN MUDMINNOW
GOLDEN SHINER
LARGEMOUTH BASS
LEAST BROOK LAMPREY
MOSQUITOFISH
PIRATE PERCH
PUMPKINSEED
REDBREAST SUNFISH
REDFIN PICKEREL
SATINFIN SHINER
SWALLOWTAIL SHINER
SWAMP DARTER
TADPOLE MADTOM
TESSELLATED DARTER
YELLOW BULLHEAD
YELLOW PERCH

Exotic Plants Present

JAPANESE HONEYSUCKLE
MILE-A-MINUTE
PHRAGMITES

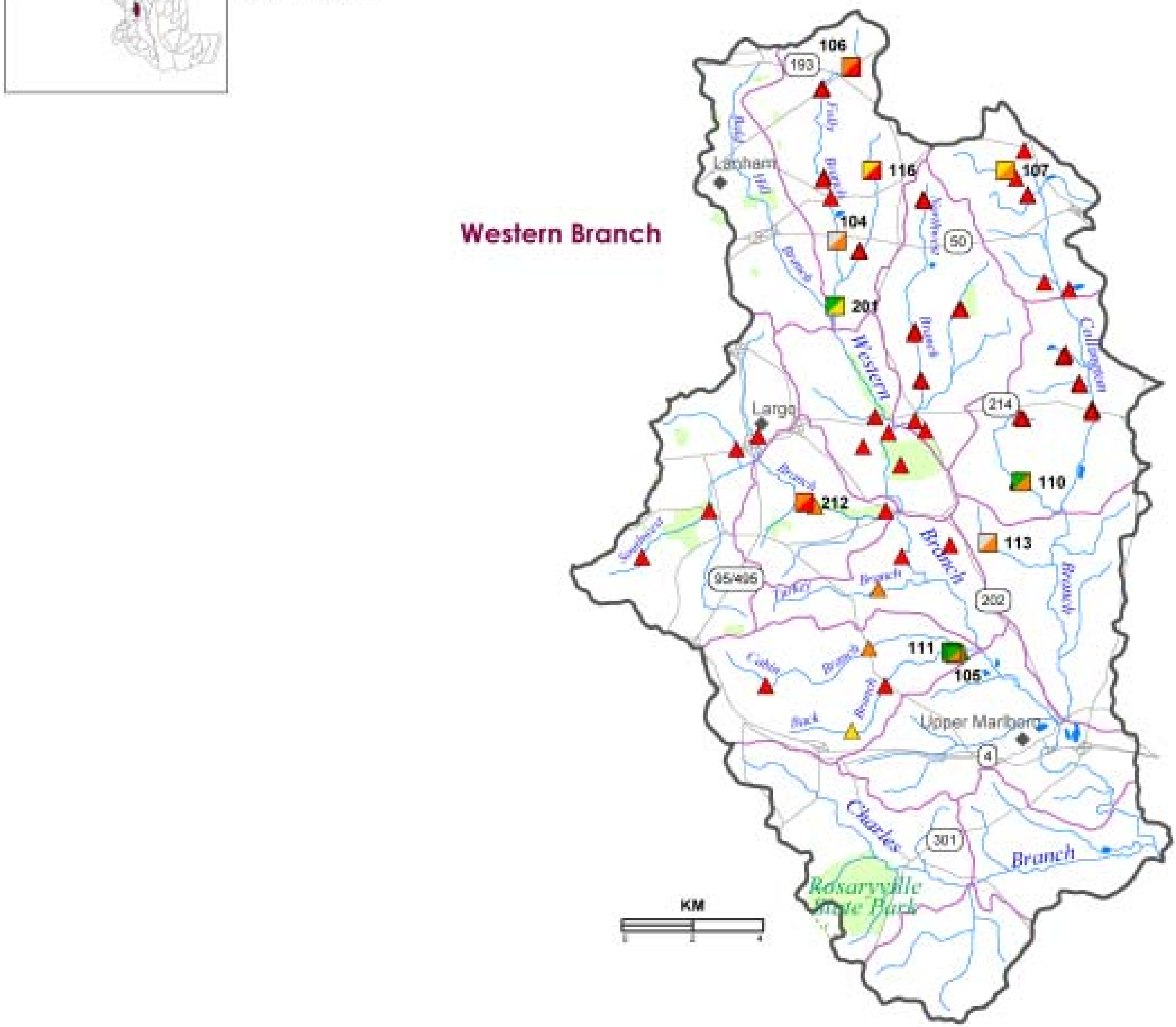
Benthic Taxa Present

ABLABESMYIA
AEDES
AGABUS
AMNICOLA
ANCYRONYX
APSECTROTANYPUS
BELOSTOMA
BEZZIA
BOYERIA
CAECIDOTEA
CAENIS
CALOPTERYX
CAMBARIDAE
CERATOPOGON
CERATOPOGONIDAE
CHAULIODES
CHEUMATOPSYCHE
CLINOTANYPUS
CNEPHIA
COENAGRIONIDAE
CONCHAPELOPIA
CORIXIDAE
CORYNONEURA
CRANGONYX
CRICOTOPUS/ORTHOCLADIUS
CRYPTOCHIRONOMUS
DICROTENDIPES
DINEUTUS
DIPLOCLADIUS
DUBIRAPHIA
DUGESIA
DYTISCIDAE
ENALLAGMA
ENCHYTRAEIDAE
ENDOCHIRONOMUS
FERRISSIA
GAMMARUS
GORDIIDAE
GYRINUS
HEMERODROMIA
HYDROBAENUS
HYDROPORUS
IRONOQUIA
ISCHNURA
ISOTOMURUS
LABRUNDINIA
LEPTOCERIDAE
LEPTOPHLEBIIDAE
LESTES
LIMNEPHILIDAE
LIMNODRILUS
LIMNOPHYES
LUMBRICULIDAE
MENETUS
MEROPELOPIA
MESOSMITTIA
MUSCULIUM
NAIDIDAE
ORTHOCLADIINAE
ORTHOCLADIUS
PALAEMONETES
PALMACORIXA
PARAKIEFFERIELLA
PARAMERINA
PARATANYTARSUS
PELTODYTES
PHAENOPSECTRA
PHYSELLA
POLYCENTROPODIDAE
POLYCENTROPUS
POLYPEDILUM
POTTHASTIA
PROCLADIUS
PROSTOMA
PSECTROCLADIUS
PSEUDOLIMNOPHILA
PYCNOPSYCHE
RHEOCRICOTOPUS
RHEOTANYTARSUS
SIMULIIDAE
SIMULIUM
SOMATOCHLORA
SPHAERIIDAE
SPHAERIUM
STEGOPTERNA
STENACRON
STENELMIS
STENONEMA
STICTOCHIRONOMUS
STILOCLADIUS
SYNURELLA
TAENIOPTERYX
TANYPODINAE
TANYPUS
TANYTARSUS
THIENEMANNIMYIA GROUP
TRIAENODES
TRIBELOS
TUBIFICIDAE
TVETENIA
ZALUTSCHIA
ZAVRELIMYIA

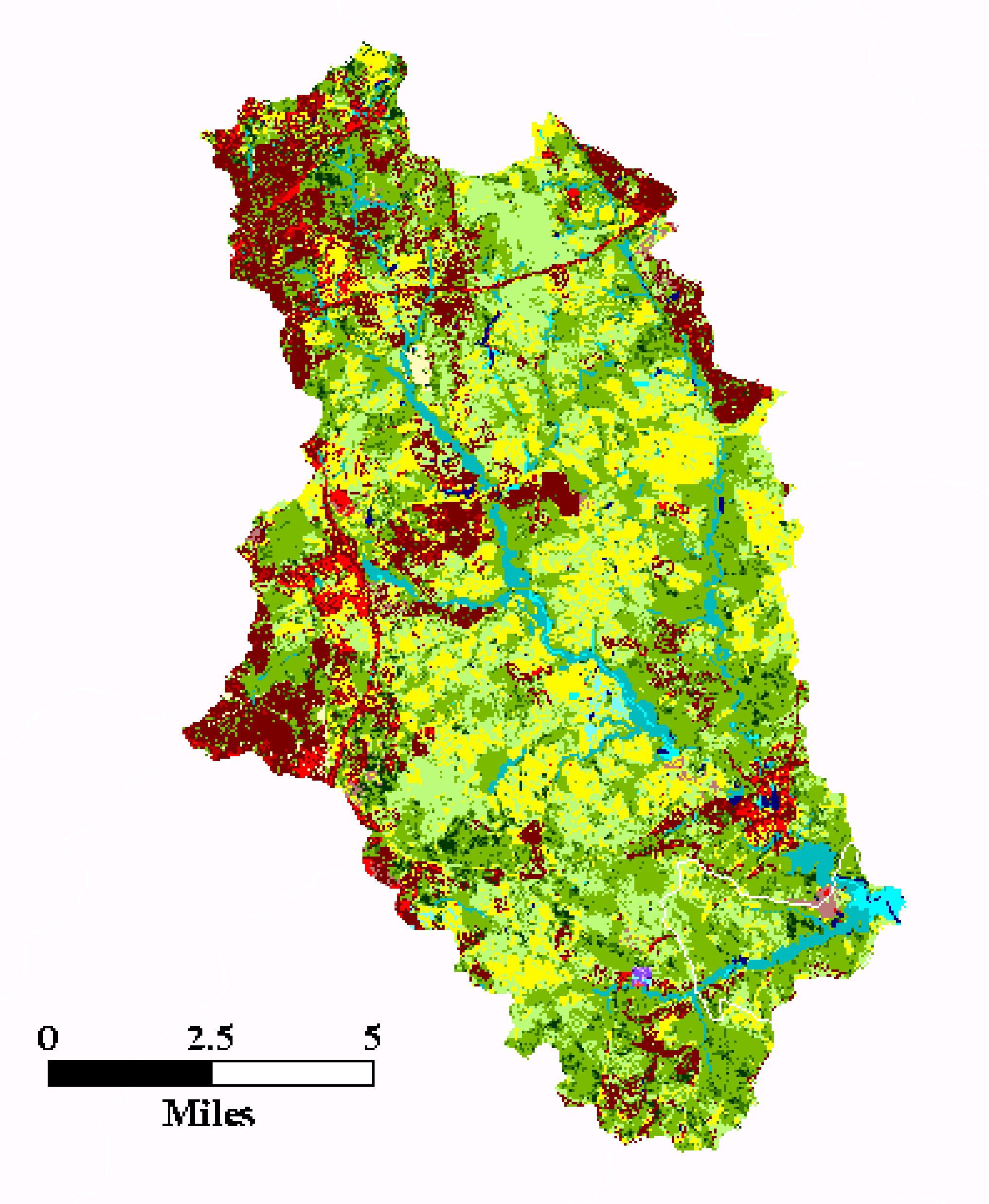
Herpetofauna Present

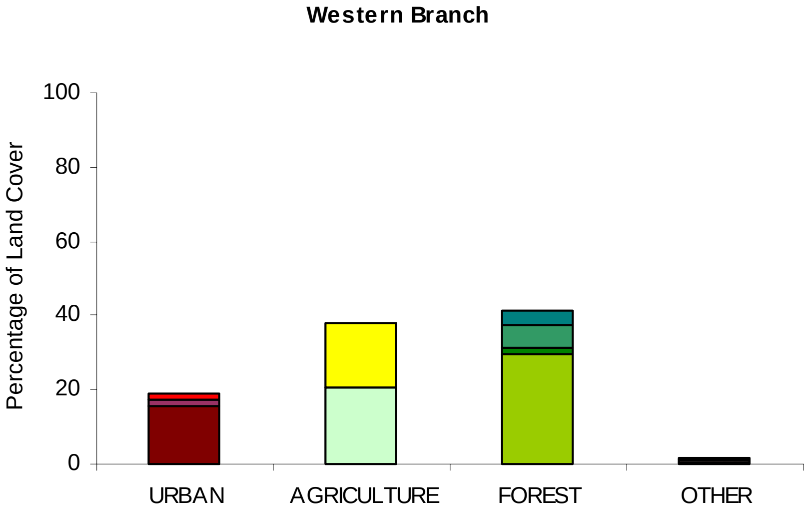
BULLFROG
COMMON SNAPPING TURTLE
EASTERN PAINTED TURTLE
GREEN FROG
NORTHERN WATER SNAKE
PICKEREL FROG
SOUTHERN LEOPARD FROG

Western Branch watershed
MBSS 2001



Western Branch





Western Branch

Site Information

Site	Stream Name	12-Digit Subwatershed Code	8-digit Watershed	Basin	County	Date Sampled Spring	Date Sampled Summer	Order	Catchment Area (acres)
WEBR-104-R-2001	FOLLY BR	021311030929	Western Branch	PATUXENT RIVER	Prince Georges	23-Mar-01	7-Aug-01	1	3863
WEBR-105-R-2001	BACK BR	021311030919	Western Branch	PATUXENT RIVER	Prince Georges	27-Mar-01	25-Jul-01	1	1702
WEBR-106-R-2001	FOLLEY BR UT1	021311030929	Western Branch	PATUXENT RIVER	Prince Georges	23-Mar-01	14-Jun-01	1	391
WEBR-107-R-2001	COLLINGTON BR UT1	021311030927	Western Branch	PATUXENT RIVER	Prince Georges	23-Mar-01	24-Jul-01	1	773
WEBR-110-R-2001	BLACK BR	021311030923	Western Branch	PATUXENT RIVER	Prince Georges	28-Mar-01	25-Jul-01	1	1737
WEBR-111-R-2001	BACK BR	021311030919	Western Branch	PATUXENT RIVER	Prince Georges	27-Mar-01	25-Jul-01	1	1695
WEBR-113-R-2001	COLLINGTON BR UT4	021311030920	Western Branch	PATUXENT RIVER	Prince Georges	28-Mar-01	14-Jun-01	1	289
WEBR-116-R-2001	LOTTSFORD BR	021311030929	Western Branch	PATUXENT RIVER	Prince Georges	23-Mar-01	14-Jun-01	1	319
WEBR-201-R-2001	LOTTSFORD BR	021311030929	Western Branch	PATUXENT RIVER	Prince Georges	23-Mar-01	24-Jul-01	2	5965
WEBR-212-R-2001	SOUTHWEST BR	021311030922	Western Branch	PATUXENT RIVER	Prince Georges	28-Mar-01	7-Aug-01	2	8523

Indicator Information

Site	FIBI	BIBI	PHI	Brook Trout Present	Black Water Stream
WEBR-104-R-2001	NS	2.71	NS	NS	NS
WEBR-105-R-2001	4.50	2.43	82.16	0	0
WEBR-106-R-2001	2.25	1.86	26.36	0	0
WEBR-107-R-2001	3.25	2.43	62.06	0	0
WEBR-110-R-2001	4.75	2.71	81.84	0	0
WEBR-111-R-2001	4.75	2.71	87.01	0	0
WEBR-113-R-2001	NR	2.71	75.19	0	0
WEBR-116-R-2001	3.50	1.86	58.64	0	0
WEBR-201-R-2001	4.50	3.00	50.47	0	0
WEBR-212-R-2001	2.75	1.86	89.72	0	0

Catchment Land Use Information

Site	Percent Urban	Percent Agriculture	Percent Forest	Percent Other	Percent Impervious Surface
WEBR-104-R-2001	33.49	17.12	47.98	1.41	11.13
WEBR-105-R-2001	8.13	45.48	45.72	0.67	2.26
WEBR-106-R-2001	7.87	36.22	53.90	2.01	2.61
WEBR-107-R-2001	3.71	69.73	26.15	0.41	1.34
WEBR-110-R-2001	1.56	65.12	32.47	0.85	0.76
WEBR-111-R-2001	8.16	45.52	45.65	0.67	2.27
WEBR-113-R-2001	0.11	69.47	29.33	1.09	0.08
WEBR-116-R-2001	28.11	27.51	44.08	0.30	7.52
WEBR-201-R-2001	31.82	24.16	42.94	1.08	10.00
WEBR-212-R-2001	41.37	27.54	30.00	1.08	15.26

Interpretation of Watershed Condition

- Several sites located in urban catchments
- Chloride, nitrogen, (particularly ammonia) and phosphorous elevated at all sites
- DO low at several sites
- Turbidity high at several sites
- Physical habitat parameters generally good
- Channelization at several sites throughout watershed

Western Branch

Water Chemistry Information

Site	Closed Ph	Specific Cond.	ANC (µeq/L)	Cl (mg/L)	Nitrate-N (mg/L)	SO4 (mg/L)	T-P (mg/L)	Ortho-P (mg/L)	Nitrite (mg/L)	Ammonia (mg/L)	T-N (mg/L)	DOC (mg/L)	DO (mg/L)	Turbidity (mg/L)
WEBR-104-R-2001	7.13	370.3	577.2	74.960	0.278	17.581	0.0459	0.007	0.0004	0.032	0.494	9.494	NS	NS
WEBR-105-R-2001	7.16	257.6	261.3	37.172	0.871	31.415	0.0337	0.007	0.0042	0.065	1.094	1.639	7.2	5.9
WEBR-106-R-2001	7.12	368.5	620.3	65.402	0.240	24.756	0.0763	0.007	0.0017	0.040	0.754	10.446	2.3	5.9
WEBR-107-R-2001	6.46	136.8	193.0	17.628	0.345	17.616	0.0862	0.004	0.0004	0.063	0.542	3.556	1.9	95.4
WEBR-110-R-2001	7.20	191.9	566.1	17.583	0.449	26.521	0.0706	0.021	0.0030	0.035	0.565	2.250	6.9	18.5
WEBR-111-R-2001	7.18	258.8	258.1	37.002	0.879	31.480	0.0357	0.006	0.0043	0.066	1.087	1.624	7.4	5
WEBR-113-R-2001	7.22	363.6	1233.1	30.490	0.383	54.728	0.0737	0.006	0.0126	0.365	1.871	3.251	8.2	9.4
WEBR-116-R-2001	6.28	187.0	170.2	24.027	1.002	25.890	0.0235	0.001	0.0037	0.075	1.278	3.614	7.7	9.5
WEBR-201-R-2001	7.05	351.5	513.7	67.380	0.319	17.691	0.0589	0.001	0.0072	0.056	0.671	8.485	3.9	13.2
WEBR-212-R-2001	7.37	494.5	1151.7	77.519	0.413	39.301	0.0300	0.001	0.0028	0.006	0.930	2.760	6.7	4.4

Physical Habitat Condition

Site	Riparian Buffer Width Left	Riparian Buffer Width Right	Adjacent Cover Left	Adjacent Cover Right	Instream Habitat Structure	Epifaunal Substrate	Velocity/ Depth Diversity	Pool/ Glide/ Eddy Quality	Extent of Pools (m)	Riffle/ Run Quality	Extent of Riffles (m)	Embed-dedness	Shading	Trash Rating	Maximum Depth (cm)
WEBR-104-R-2001	50	35	FR	HO	NS	NS	NS	NS	NS	NS	NS	NS	NS	11	NS
WEBR-105-R-2001	50	50	FR	FR	13	14	12	13	65	7	11	20	85	14	69
WEBR-106-R-2001	40	10	HO	PV	8	14	7	7	20	7	6	35	92	9	37
WEBR-107-R-2001	50	45	FR	HO	12	11	10	15	73	3	0	100	77	13	70
WEBR-110-R-2001	50	50	FR	FR	12	4	12	14	68	6	9	40	85	15	82
WEBR-111-R-2001	50	50	FR	FR	15	15	12	14	45	8	41	17	89	15	65
WEBR-113-R-2001	50	50	FR	FR	12	12	11	15	72	6	3	35	70	7	81
WEBR-116-R-2001	50	50	FR	FR	13	10	12	12	50	8	30	100	90	15	47
WEBR-201-R-2001	50	50	LN	LN	11	9	7	9	66	7	12	35	95	16	47
WEBR-212-R-2001	50	50	FR	FR	13	10	13	15	65	11	25	25	70	10	122

Physical Habitat Modifications

Site	Buffer Breaks?	Surface Mine?	Landfill?	Channelization?	Erosion Severity Left	Erosion Severity Right	Bar Formation
WEBR-104-R-2001	N	N	N	N	NS	NS	NS
WEBR-105-R-2001	N	N	N	N	Mild	Mild	Severe
WEBR-106-R-2001	Y	N	N	Y	Moderate	Moderate	Moderate
WEBR-107-R-2001	N	N	N	N	None	None	None
WEBR-110-R-2001	Y	N	N	N	Severe	Moderate	Minor
WEBR-111-R-2001	N	N	N	N	Moderate	Moderate	Severe
WEBR-113-R-2001	N	N	N	Y	Moderate	Moderate	Moderate
WEBR-116-R-2001	N	N	N	Y	Mild	Mild	Minor
WEBR-201-R-2001	N	N	N	Y	Severe	Severe	Severe
WEBR-212-R-2001	N	N	N	N	Moderate	Moderate	Severe

Western Branch

Stream Waders Data

Site	8-Digit Watershed	12-Digit Subwatershed	Stream name	Benthic IBI
0923-4	Western Branch	021311030923	COLLINGTON BR UT	1.00
0923-93	Western Branch	021311030923	COLLINGTON BR	1.86
0919-2	Western Branch	021311030919	BACK BR	1.86
0923-5	Western Branch	021311030923	COLLINGTON BR UT	1.57
0923-95	Western Branch	021311030923	COLLINGTON BR UT	2.14
0927-83	Western Branch	021311030927	COLLINGTON BR UT	1.29
0927-4	Western Branch	021311030927	COLLINGTON BR UT	1.00
0927-3	Western Branch	021311030927	COLLINGTON BR UT	1.57
0927-84	Western Branch	021311030927	COLLINGTON BR	1.00
0927-82	Western Branch	021311030927	COLLINGTON BR UT	1.29
0923-85	Western Branch	021311030923	COLLINGTON BR UT	1.57
0927-2	Western Branch	021311030927	COLLINGTON BR UT	1.57
0927-1	Western Branch	021311030927	COLLINGTON BR	1.29
0923-3	Western Branch	021311030923	COLLINGTON BR	1.57
0923-83	Western Branch	021311030923	COLLINGTON BR	2.43
0923-94	Western Branch	021311030923	COLLINGTON BR UT	1.29
0923-81	Western Branch	021311030923	BLACK BR	1.57
0923-1	Western Branch	021311030923	BLACK BR	1.57
0923-91	Western Branch	021311030923	BLACK BR	1.86
0923-84	Western Branch	021311030923	COLLINGTON BR UT	1.57
0929-3	Western Branch	021311030929	FOLLY BR	1.00
0923-2	Western Branch	021311030923	BLACK BR	1.29
0923-82	Western Branch	021311030923	BLACK BR	1.57
0927-5	Western Branch	021311030927	COLLINGTON BR UT	1.29
0929-4	Western Branch	021311030929	FOLLY BR	1.29
0919-4	Western Branch	021311030919	BACK BR	4.14
0926-3	Western Branch	021311030926	NORTHEAST BR UT	1.00
0922-1	Western Branch	021311030922	SOUTHWEST BR	2.43
0926-83	Western Branch	021311030926		1.57
0922-2	Western Branch	021311030922	SOUTHWEST BR	1.57
0921-1	Western Branch	021311030921	WESTERN BR UT	1.86
0929-83	Western Branch	021311030929	FOLLY BR	1.57
0926-5	Western Branch	021311030926	NORTHEAST BR UT	1.00
0926-81	Western Branch	021311030926	NORTHEAST BR	1.86
0926-1	Western Branch	021311030926	NORTHEAST BR	1.29
0926-84	Western Branch	021311030926	NORTHEAST BR	1.29
0926-4	Western Branch	021311030926	NORTHEAST BR	1.57
0926-85	Western Branch	021311030926	NORTHEAST BR	1.57
0926-82	Western Branch	021311030926	NORTHEAST BR	1.86
0926-2	Western Branch	021311030926	NORTHEAST BR	1.29
0924-4	Western Branch	021311030924		1.57
0919-5	Western Branch	021311030919	CABIN BR CR	1.86
0921-2	Western Branch	021311030921	WESTERN BR UT	1.57
0925-2	Western Branch	021311030925	WESTERN BR UT	1.86
0919-3	Western Branch	021311030919	CABIN BR CR	2.71
0925-4	Western Branch	021311030925	WESTERN BR	1.86
Site	**8-Digit Watershed**	**12-Digit Subwatershed**	**Stream name**	**Benthic IBI**
0925-1	Western Branch	021311030925		1.86

Western Branch

0924-3	Western Branch	021311030924		1.57
0929-82	Western Branch	021311030929	FOLLY BR	1.57
0919-1	Western Branch	021311030919	BACK BR	3.00
0924-1	Western Branch	021311030924	UNNAMED STREAM	1.57
0924-2	Western Branch	021311030924		1.57
0921-3	Western Branch	021311030921	TURKEY BR	2.71
0929-84	Western Branch	021311030929	FOLLEY BR UT	1.57
0929-81	Western Branch	021311030929	LOTTSFORD BR	1.57
0929-1	Western Branch	021311030929	LOTTSFORD BR	1.00
0925-3	Western Branch	021311030925	WESTERN BR UT	1.00

Western Branch

Fish Species Present

AMERICAN BROOK LAMPREY
AMERICAN EEL
BLACKNOSE DACE
BLUEGILL
BLUESPOTTED SUNFISH
BROWN BULLHEAD
CHAIN PICKEREL
CREEK CHUB
CREEK CHUBSUCKER
EASTERN MUDMINNOW
FALLFISH
GLASSY DARTER
GOLDEN SHINER
LEAST BROOK LAMPREY
MARGINED MADTOM
PIRATE PERCH
PUMPKINSEED
REDBREAST SUNFISH
REDFIN PICKEREL
ROSYSIDE DACE
SATINFIN SHINER
SEA LAMPREY
SWALLOWTAIL SHINER
TESSELLATED DARTER
WHITE SUCKER
YELLOW BULLHEAD

Exotic Plants Present

JAPANESE HONEYSUCKLE
MULTIFLORA ROSE
MILE-A-MINUTE
MICROSTEGIUM
TREE OF HEAVEN

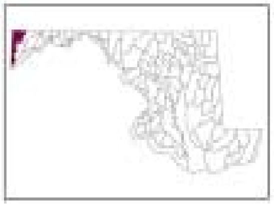
Benthic Taxa Present

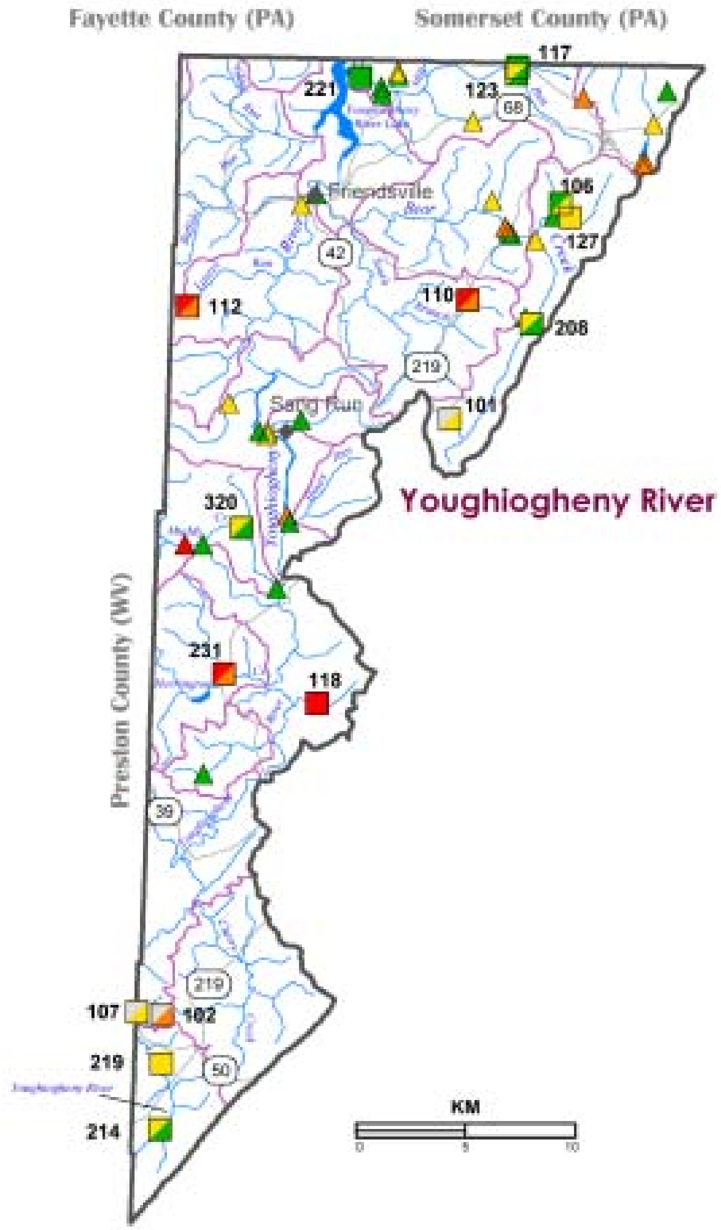
ABLABESMYIA
AMPHIPODA
ANCYRONYX
ARGIA
BEZZIA
BOYERIA
BRILLIA
CAECIDOTEA
CAENIS
CALLIBAETIS
CALOPTERYX
CERATOPOGON
CERATOPOGONIDAE
CHAETOCLADIUS
CHAOBORUS
CHELIFERA
CHEUMATOPSYCHE
CHIRONOMINI
CHIRONOMUS
COENAGRIONIDAE
CONCHAPELOPIA
CORYNONEURA
CRAMBUS
CRANGONYX
CRICOTOPUS
CRICOTOPUS/ORTHOCLADIUS
CRYPTOCHIRONOMUS
CYPHON
DICROTENDIPES
DIPLOCLADIUS
DOLICHOPODIDAE
DUBIRAPHIA
ENCHYTRAEIDAE
ENDOCHIRONOMUS
EPHEMERELLA
EUKIEFFERIELLA
GAMMARUS
GORDIIDAE
GUTTIPELOPIA
HEMERODROMIA
HESPEROCORIXA
HEXATOMA
HYDROBAENUS
HYDROPORUS
HYDROPSYCHE
HYDROPSYCHIDAE
IRONOQUIA
ISOPERLA
ISOTOMIDAE
ISOTOMURUS
KIEFFERULUS
LARSIA
LEPIDOPTERA
LIMNEPHILIDAE
LIMNODRILUS
LUMBRICULIDAE
LUMBRICULIDAE
LYPE
MENETUS
MEROPELOPIA
MICROPSECTRA
NAIDIDAE
NANOCLADIUS
NEOPHYLAX
NIGRONIA
NOTONECTA
ORTHOCLADIINAE
ORTHOCLADIINAE A
ORTHOCLADIUS
PACHDIPLAX
PARACHIRONOMUS
PARAMETRIOCNEMUS
PARATANYTARSUS
PHAENOPSECTRA
PHYSELLA
POLYPEDILUM
PROSIMULIUM
PROSTOIA
PSEUDOLIMNOPHILA
PSEUDORTHOCLADIUS
PSEUDOSUCCINEA
PTILOSTOMIS
PYRALIDAE
RHABDOMASTIX
RHEOCRICOTOPUS
RHEOTANYTARSUS
SIALIS
SIMULIIDAE
SIMULIUM
SPHAERIIDAE
SPHAERIUM
STAGNICOLA
STEGOPTERNA
STENELMIS
STENOCHIRONOMUS
STENONEMA
STICTOCHIRONOMUS
SYMPOSIOCLADIUS
TANYPODINAE
TANYPUS
TANYTARSINI
TANYTARSUS
THIENEMANNIELLA
THIENEMANNIMYIA GROUP
TIPULA
TIPULIDAE
TUBIFICIDAE
VIVIPARUS
ZAVRELIMYIA

Herpetofauna Present

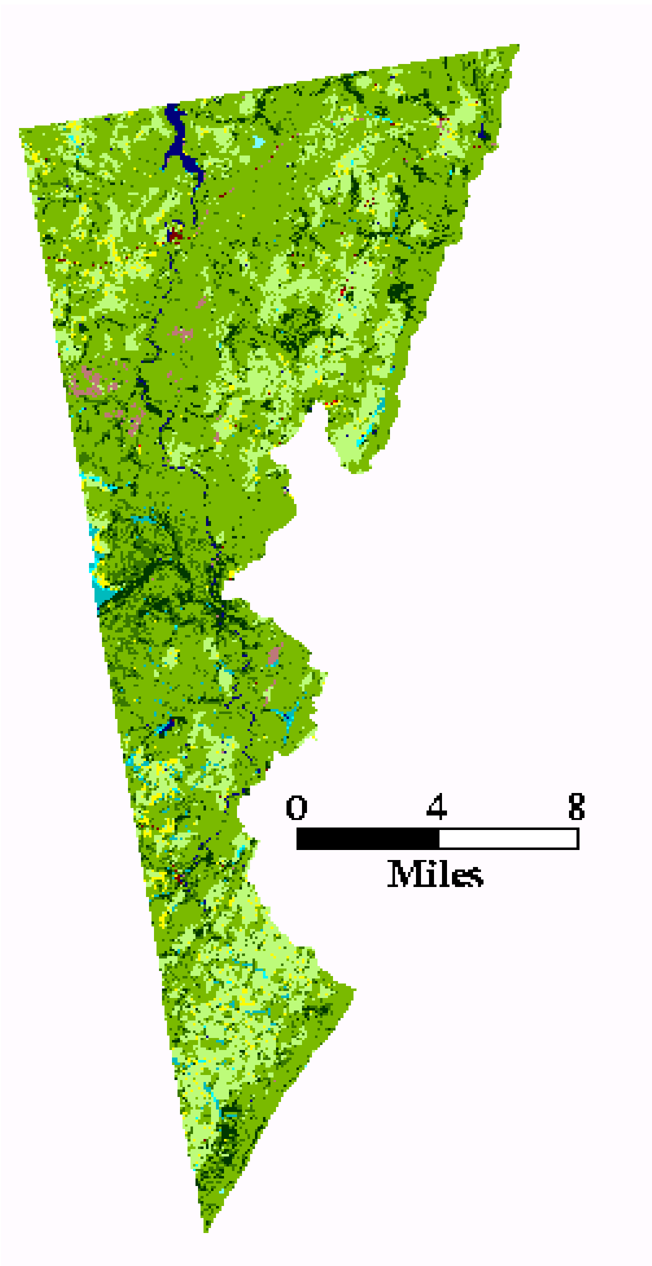
AMERICAN TOAD
BULLFROG
EASTERN MUD TURTLE
FOWLER'S TOAD
GREEN FROG
NORTHERN SPRING PEEPER
NORTHERN TWO-LINED SALAMANDER
NORTHERN WATER SNAKE
PICKEREL FROG
SOUTHERN LEOPARD FROG
WOOD FROG

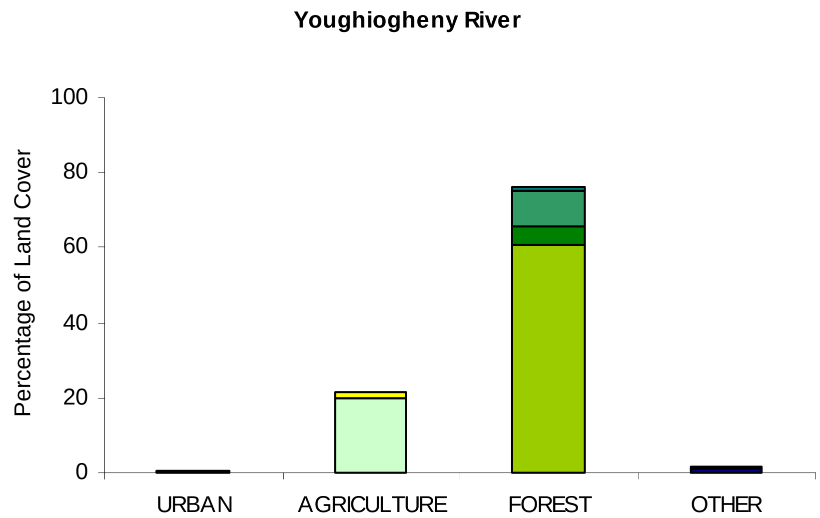
Youghiogheny River watershed
MBSS 2001





Youghiogheny River





Youghiogheny River

Site Information

Site	Stream Name	12-Digit Subwatershed Code	8-digit Watershed	Basin	County	Date Sampled Spring	Date Sampled Summer	Order	Catchment Area (acres)
YOUG-101-R-2001	BEAR CR UT2	050202010016	Youghiogheny River	YOUGHIOGHENY RIVER	Garrett	23-Mar-01	28-Jun-01	1	191
YOUG-102-R-2001	YOUGHIOGHENY R UT1	050202010005	Youghiogheny River	YOUGHIOGHENY RIVER	Garrett	03-Apr-01	6-Aug-01	1	153
YOUG-106-R-2001	LITTLE BEAR CR UT1	050202010016	Youghiogheny River	YOUGHIOGHENY RIVER	Garrett	03-Apr-01	20-Jun-01	1	505
YOUG-107-R-2001	YOUGHIOGHENY R UT2	050202010005	Youghiogheny River	YOUGHIOGHENY RIVER	Garrett	03-Apr-01	6-Aug-01	1	164
YOUG-110-R-2001	SOUTH BR BEAR CR UT2 UT1	050202010015	Youghiogheny River	YOUGHIOGHENY RIVER	Garrett	23-Mar-01	20-Aug-01	1	711
YOUG-112-R-2001	LAUREL RUN	050202010017	Youghiogheny River	YOUGHIOGHENY RIVER	Garrett	05-Apr-01	27-Aug-01	1	978
YOUG-117-R-2001	MILL RUN UT2	050202010021	Youghiogheny River	YOUGHIOGHENY RIVER	Garrett	23-Mar-01	17-Jul-01	1	888
YOUG-118-R-2001	MILLERS RUN	050202010008	Youghiogheny River	YOUGHIOGHENY RIVER	Garrett	03-Apr-01	27-Aug-01	1	1452
YOUG-123-R-2001	MILL RUN	050202010021	Youghiogheny River	YOUGHIOGHENY RIVER	Garrett	23-Mar-01	17-Jul-01	1	2819
YOUG-127-R-2001	LITTLE BEAR CR	050202010016	Youghiogheny River	YOUGHIOGHENY RIVER	Garrett	03-Apr-01	20-Jun-01	1	632
YOUG-208-R-2001	BEAR BR	050202010016	Youghiogheny River	YOUGHIOGHENY RIVER	Garrett	23-Mar-01	16-Jul-01	2	3981
YOUG-214-R-2001	YOUGHIOGHENY R	050202010001	Youghiogheny River	YOUGHIOGHENY RIVER	Garrett	03-Apr-01	20-Aug-01	2	2943
YOUG-219-R-2001	YOUGHIOGHENY R	050202010001	Youghiogheny River	YOUGHIOGHENY RIVER	Garrett	03-Apr-01	9-Aug-01	2	6013
YOUG-221-R-2001	MILL RUN	050202010021	Youghiogheny River	YOUGHIOGHENY RIVER	Garrett	23-Mar-01	17-Jul-01	2	10929
YOUG-231-R-2001	MURLEY RUN	050202010009	Youghiogheny River	YOUGHIOGHENY RIVER	Garrett	05-Apr-01	28-Jun-01	2	2836
YOUG-320-R-2001	MUDDY CR	050202010010	Youghiogheny River	YOUGHIOGHENY RIVER	Garrett	05-Apr-01	16-Jul-01	3	9203

Indicator Information

Site	FIBI	BIBI	PHI	Brook Trout Present	Black Water Stream
YOUG-101-R-2001	NR	3.22	20.14	0	0
YOUG-102-R-2001	NR	2.56	27.93	0	0
YOUG-106-R-2001	4.14	3.67	77.95	1	0
YOUG-107-R-2001	NR	3.89	83.69	0	0
YOUG-110-R-2001	1.29	2.56	59.94	0	0
YOUG-112-R-2001	1.00	2.33	61.89	0	0
YOUG-117-R-2001	4.43	4.33	88.91	1	0
YOUG-118-R-2001	1.29	1.44	40.25	0	0
YOUG-123-R-2001	3.57	4.78	95.79	1	0
YOUG-127-R-2001	3.86	3.89	71.81	1	0
YOUG-208-R-2001	3.57	4.78	97.53	1	0
YOUG-214-R-2001	3.29	4.11	96.68	0	0
YOUG-219-R-2001	3.00	3.89	94.68	0	0
YOUG-221-R-2001	4.43	4.78	91.11	1	0
YOUG-231-R-2001	1.57	2.33	86.00	0	0
YOUG-320-R-2001	3.00	4.78	90.06	0	0

Catchment Land Use Information

Site	Percent Urban	Percent Agriculture	Percent Forest	Percent Other	Percent Impervious Surface
YOUG-101-R-2001	0.49	19.11	80.40	0.00	0.29
YOUG-102-R-2001	0.00	69.69	30.10	0.21	0.00
YOUG-106-R-2001	0.13	9.90	89.29	0.69	0.03
YOUG-107-R-2001	0.00	22.41	77.59	0.00	0.00
YOUG-110-R-2001	5.48	52.01	41.88	0.62	1.53
YOUG-112-R-2001	0.26	21.35	74.85	3.54	0.06
YOUG-117-R-2001	0.28	23.01	75.75	0.96	0.07
YOUG-118-R-2001	0.02	10.10	88.42	1.45	0.01
YOUG-123-R-2001	0.83	12.93	84.75	1.50	0.21
YOUG-127-R-2001	0.10	7.89	91.46	0.55	0.02
YOUG-208-R-2001	0.13	40.31	57.71	1.85	0.04
YOUG-214-R-2001	0.25	28.78	70.20	0.77	0.06
YOUG-219-R-2001	0.13	32.75	66.34	0.78	0.03
YOUG-221-R-2001	0.56	18.30	79.95	1.20	0.15
YOUG-231-R-2001	0.00	4.96	94.93	0.11	0.00
YOUG-320-R-2001	0.06	23.47	74.17	2.30	0.01

Youghiogheny River

Water Chemistry Information

Site	Closed pH	Specific Cond.	ANC (µeq/L)	Cl (mg/L)	Nitrate-N (mg/L)	SO4 (mg/L)	T-P (mg/L)	Ortho-P (mg/L)	Nitrite (mg/L)	Ammonia (mg/L)	T-N (mg/L)	DOC (mg/L)	DO (mg/L)	Turbidity (mg/L)
YOUG-101-R-2001	5.42	41.6	10.8	1.597	0.455	9.567	0.0042	0.001	0.0004	0.002	0.461	0.596	7.9	0.6
YOUG-102-R-2001	6.52	38.7	83.8	1.832	0.548	5.762	0.0212	0.005	0.0024	0.048	0.665	1.102	6.9	10
YOUG-106-R-2001	7.35	354.5	220.0	80.369	0.723	11.026	0.0039	0.001	0.0015	0.004	0.709	0.637	7.8	3
YOUG-107-R-2001	6.97	46.3	89.7	1.871	0.830	7.224	0.0092	0.003	0.0014	0.004	0.890	0.560	8.2	10
YOUG-110-R-2001	7.26	186.8	465.1	20.177	2.719	15.637	0.0206	0.001	0.0033	0.002	3.006	1.189	8.3	2.7
YOUG-112-R-2001	4.97	41.1	-2.9	1.276	0.246	10.818	0.0072	0.001	0.0004	0.011	0.257	0.476	7.2	8.7
YOUG-117-R-2001	6.95	166.5	108.3	35.358	1.360	6.580	0.0091	0.001	0.0006	0.002	1.466	0.791	9.5	2
YOUG-118-R-2001	6.27	81.9	105.7	11.589	0.407	7.954	0.0116	0.001	0.0022	0.007	0.467	1.783	4.8	8.1
YOUG-123-R-2001	6.07	474.9	90.8	118.897	0.912	13.312	0.0070	0.001	0.0004	0.010	1.021	0.942	8.8	2.4
YOUG-127-R-2001	7.28	299.5	187.9	63.067	0.676	11.129	0.0037	0.002	0.0019	0.004	0.728	0.710	7.5	2.2
YOUG-208-R-2001	6.90	63.9	101.6	2.970	1.477	9.066	0.0147	0.001	0.0033	0.018	1.726	1.646	8.6	6.2
YOUG-214-R-2001	7.13	75.3	194.5	6.977	0.927	6.716	0.0114	0.002	0.0017	0.012	1.005	1.088	9.8	6.3
YOUG-219-R-2001	7.00	81.5	156.4	12.462	1.032	6.697	0.0098	0.003	0.0023	0.008	1.106	1.010	6.2	13.6
YOUG-221-R-2001	7.27	286.3	146.2	60.507	1.003	15.100	0.0076	0.001	0.0012	0.002	1.079	1.262	8.8	0.8
YOUG-231-R-2001	4.87	29.7	-6.4	0.895	0.184	7.611	0.0042	0.001	0.0006	0.005	0.156	0.654	8.8	1.9
YOUG-320-R-2001	6.69	42.8	88.8	2.397	0.359	6.995	0.0114	0.001	0.0015	0.007	0.423	1.644	8.3	5.3

Physical Habitat Condition

Site	Riparian Buffer Width Left	Riparian Buffer Width Right	Adjacent Cover Left	Adjacent Cover Right	Instream Habitat Structure	Epifaunal Substrate	Velocity/ Depth Diversity	Pool/ Glide/ Eddy Quality	Extent of Pools (m)	Riffle/ Run Quality	Extent of Riffles (m)	Embed-dedness	Shading	Trash Rating	Maximum Depth (cm)
YOUG-101-R-2001	50	50	FR	FR	7	13	6	6	15	6	55	20	96	20	21
YOUG-102-R-2001	50	0	FR	PV	11	7	7	8	60	9	15	45	86	14	38
YOUG-106-R-2001	50	50	FR	FR	18	16	10	10	30	16	55	15	95	17	38
YOUG-107-R-2001	50	50	FR	FR	16	15	14	16	40	13	43	38	96	18	68
YOUG-110-R-2001	14	50	PK	OF	17	15	11	14	40	15	40	25	97	11	52
YOUG-112-R-2001	50	50	FR	FR	15	10	10	8	25	14	28	35	95	19	22
YOUG-117-R-2001	50	50	FR	FR	13	11	10	9	42	12	35	35	92	16	46
YOUG-118-R-2001	50	50	FR	FR	16	15	10	18	75	0	0	100	40	20	116
YOUG-123-R-2001	50	50	FR	FR	18	14	13	17	50	16	30	20	90	19	70
YOUG-127-R-2001	50	50	FR	FR	16	16	10	10	45	18	40	15	92	18	32
YOUG-208-R-2001	50	50	FR	FR	18	16	15	17	45	16	34	25	80	19	74
YOUG-214-R-2001	0	0			15	11	10	16	70	0	0	40	45	16	83
YOUG-219-R-2001	0	50	PA	OF	17	15	10	13	41	16	38	20	55	16	49
YOUG-221-R-2001	6	50	PV	FR	18	18	15	18	40	19	40	35	75	16	104
YOUG-231-R-2001	50	50	FR	FR	10	9	8	8	33	12	47	50	60	20	47
YOUG-320-R-2001	50	50	FR	FR	17	13	15	16	60	17	25	25	30	19	78

Interpretation of Watershed Condition

- ANC values low throughout watershed
- Chloride and nitrogen values elevated at some sites
- Physical habitat parameters generally good

Youghiogheny River

Physical Habitat Modifications

Site	Buffer Breaks?	Surface Mine?	Landfill?	Channelization?	Erosion Severity Left	Erosion Severity Right	Bar Formation
YOUG-101-R-2001	N	N	N	N	None	None	Minor
YOUG-102-R-2001	Y	N	N	N	Mild	Mild	Moderate
YOUG-106-R-2001	N	N	N	N	Mild	Moderate	None
YOUG-107-R-2001	N	N	N	N	Moderate	Moderate	Moderate
YOUG-110-R-2001	Y	N	N	N	None	None	None
YOUG-112-R-2001	N	Y	N	N	None	None	Minor
YOUG-117-R-2001	N	N	N	N	None	None	Severe
YOUG-118-R-2001	N	N	N	N	None	None	None
YOUG-123-R-2001	N	N	N	N	Mild	Mild	Moderate
YOUG-127-R-2001	N	N	N	N	None	Mild	None
YOUG-208-R-2001	N	N	N	N	None	None	Minor
YOUG-214-R-2001	Y	N	N	N	Moderate	Moderate	Moderate
YOUG-219-R-2001	N	N	N	N	Mild	Mild	Minor
YOUG-221-R-2001	N	N	N	N	Mild	Mild	Minor
YOUG-231-R-2001	N	N	N	N	Moderate	Mild	Moderate
YOUG-320-R-2001	N	N	N	N	None	None	Minor

Youghiogheny River

Stream Waders Data

Site	8-Digit Watershed	12-Digit Subwatershed	Stream name	Benthic IBI
0010-3	Youghiogheny River	050202010010	MUDDY CR (YG) 200 METERS UPSTREAM FROM CRANESVILLE ROAD	1.29
0021-3	Youghiogheny River	050202010021	MILL RUN UT	3.29
0010-2	Youghiogheny River	050202010010	MUDDY CR (YG) AT BROWNING DAM	5.00
0022-3	Youghiogheny River	050202010022	PUZZLEY RUN UT	4.43
0022-1	Youghiogheny River	050202010022	PUZZLEY RUN	3.86
0022-5	Youghiogheny River	050202010022	PUZZLEY RUN UT	2.14
0022-4	Youghiogheny River	050202010022	PUZZLEY RUN UT	2.43
0022-2	Youghiogheny River	050202010022	PUZZLEY RUN UT	2.43
0016-1	Youghiogheny River	050202010016	LITTLE BEAR CR	5.00
0016-5	Youghiogheny River	050202010016	BEAR CR	3.00
0016-4	Youghiogheny River	050202010016	BEAR CR	4.43
0016-3	Youghiogheny River	050202010016	BEAR CR UT	4.43
0018-2	Youghiogheny River	050202010018	BEAR CR	5.00
0018-1	Youghiogheny River	050202010018	BEAR CR UT	5.00
0018-4	Youghiogheny River	050202010018	BEAR CR UT	2.71
0018-3	Youghiogheny River	050202010018	COVE RUN	3.29
0021-5	Youghiogheny River	050202010021	COVE RUN	3.29
0018-5	Youghiogheny River	050202010018	BEAR CR UT	5.00
0016-2	Youghiogheny River	050202010016	BEAR CR UT	2.14
0021-4	Youghiogheny River	050202010021	MILL RUN UT	4.43
0011-2	Youghiogheny River	050202010011	YOUGHIOGHENY R 1/2 MILE UPSTREAM FROM POWERHOUSE	2.14
0011-1	Youghiogheny River	050202010011	YOUGHIOGHENY R AT HOYES RUN CONFLUENCE	4.71
0021-2	Youghiogheny River	050202010021		4.14
0021-1	Youghiogheny River	050202010021	MILL RUN	4.43
0007-1	Youghiogheny River	050202010007	DUNKARD LICK RUN	4.43
0020-1	Youghiogheny River	050202010020	BEAR CR (YG) AT 2ND ST. BRIDGE IN FRIENDSVILLE	4.14
0017-2	Youghiogheny River	050202010017	YOUGHIOGHENY R AT I68 BRIDGE	3.86
0013-2	Youghiogheny River	050202010013	GINSENG RUN AT OPEN DOOR CHAPEL	5.00
0013-3	Youghiogheny River	050202010013	GINSENG RUN JUST ABOVE CONFLUENCE WITH YOUGHIOGHENY R	3.29
0011-3	Youghiogheny River	050202010011	YOUGHIOGHENY R AT GINSENG RUN CONFLUENCE	3.57
0010-1	Youghiogheny River	050202010010	MUDDY CR (YG) ABOVE MUDDY CR FALLS	4.43
0011-4	Youghiogheny River	050202010011	YOUGHIOGHENY R AT SANG RUN ROAD BRIDGE	4.14
0011-5	Youghiogheny River	050202010011	SALT BLOCK RUN	3.57

Youghiogheny River

Fish Species Present

BLACK CRAPPIE
BLACKNOSE DACE
BLUEGILL
BLUNTNOSE MINNOW
BROOK TROUT
BROWN BULLHEAD
BROWN TROUT
CENTRAL STONEROLLER
CHAIN PICKEREL
CREEK CHUB
GOLDEN SHINER
GREEN SUNFISH
GREENSIDE DARTER
JOHNNY DARTER
LARGEMOUTH BASS
LONGNOSE DACE
MARGINED MADTOM
MOTTLED SCULPIN
NORTHERN HOGSUCKER
PUMPKINSEED
RAINBOW TROUT
REDFIN PICKEREL
RIVER CHUB
ROCK BASS
ROSYSIDE DACE
SMALLMOUTH BASS
WHITE SUCKER
YELLOW BULLHEAD

Exotic Plants Present

MULTIFLORA ROSE
THISTLE

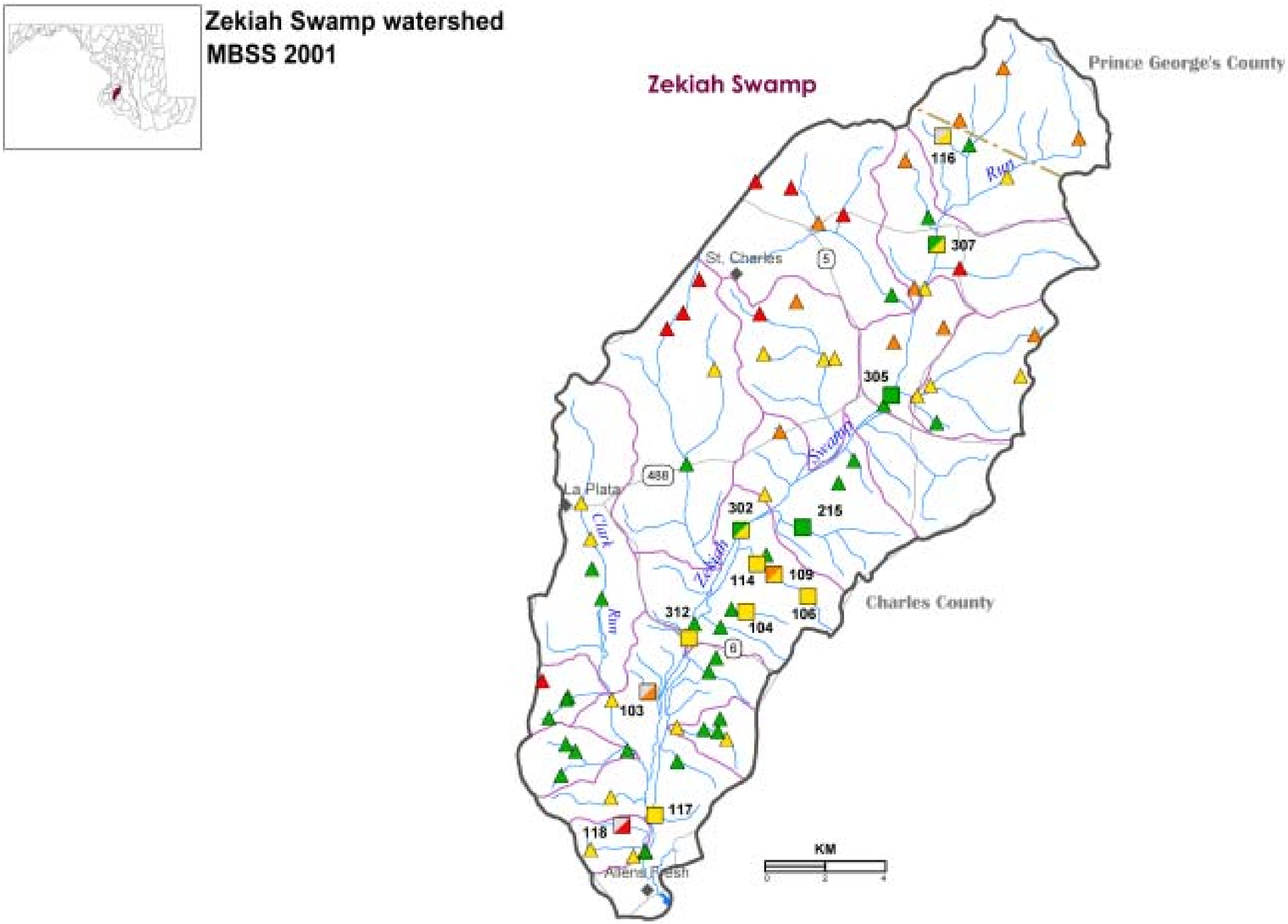
Benthic Taxa Present

ACERPENNA
ACRONEURIA
AMELETUS
AMPHINEMURA
ANTOCHA
ATHERIX
BAETIDAE
BAETIS
BRACHYCENTRIDAE
BRANCHIOBDELLIDA
BRILLIA
CAECIDOTEA
CAENIS
CAMBARIDAE
CERATOPOGON
CERATOPOGONIDAE
CHELIFERA
CHEUMATOPSYCHE
CHIMARRA
CHIRONOMIDAE
CHIRONOMINAE
CHIRONOMINI
CHLOROPERLIDAE
CHRYSOPS
CINYGMULA
CLINOCERA
CLIOPERLA
CONCHAPELOPIA
CORYNONEURA
CRANGONYCTIDAE
CRANGONYX
CRICOTOPUS
CRICOTOPUS/ORTHOCLADIUS
CRYPTOCHIRONOMUS
DIAMESA
DICRANOTA
DICROTENDIPES
DIPHETOR
DIPLECTRONA
DIPLOCLADIUS
DIPLOPERLA
DOLOPHILODES
DUBIRAPHIA
ELMIDAE
EMPIDIDAE
ENCHYTRAEIDAE
EPEORUS
EPHEMERELLA
EUKIEFFERIELLA
EURYLOPHELLA
GAMMARUS
GOERA
HEMERODROMIA
HEPTAGENIIDAE
HETEROTRISSOCLADIUS
HEXATOMA
HYALELLA
HYDROPSYCHE
HYDROPSYCHIDAE
ISOPERLA
LEPIDOSTOMA
LEPTOPHLEBIIDAE
LEUCTRA
LEUCTRIDAE
LIMNEPHILIDAE
LIMNODRILUS
LIMNOPHYES
LUMBRICULIDAE
LYPE
MICROPSECTRA
MICROTENDIPES
MOLOPHILUS
NAIDIDAE
NANOCLADIUS
NEMOURIDAE
NEOPHYLAX
NIGRONIA
NYCTIOPHYLAX
OEMOPTERYX
OPTIOSERVUS
ORMOSIA
ORTHOCLADIINAE
OSTROCERCA
OULIMNIUS
PARACAPNIA
PARACHAETOCLADIUS
PARALEPTOPHLEBIA
PARAMETRIOCNEMUS
PELTOPERLA
PELTOPERLIDAE
PERLIDAE
PERLODIDAE
PHYSELLA
POLYCENTROPODIDAE
POLYPEDILUM
PROBEZZIA
PROMORESIA
PROSIMULIUM
PSEUDOLIMNOPHILA
PSILOMETRIOCNEMUS
PTERONARCYS
RHEOCRICOTOPUS
RHEOTANYTARSUS
RHYACOPHILA
SERRATELLA
SIALIS
SIMULIIDAE
SIMULIUM
SPHAERIUM
STEGOPTERNA
STEMPELLINA
STENACRON
STENELMIS
STENONEMA
SUBLETTEA
SWELTSA
SYMPOSIOCLADIUS
TALLAPERLA
TANYPODINAE
TANYTARSINI
TANYTARSUS
THIENEMANNIELLA
THIENEMANNIMYIA
THIENEMANNIMYIA GROUP
TIPULA
TIPULIDAE
TRICHOPTERA
TUBIFICIDAE
TVETENIA
WORMALDIA
ZAVRELIMYIA

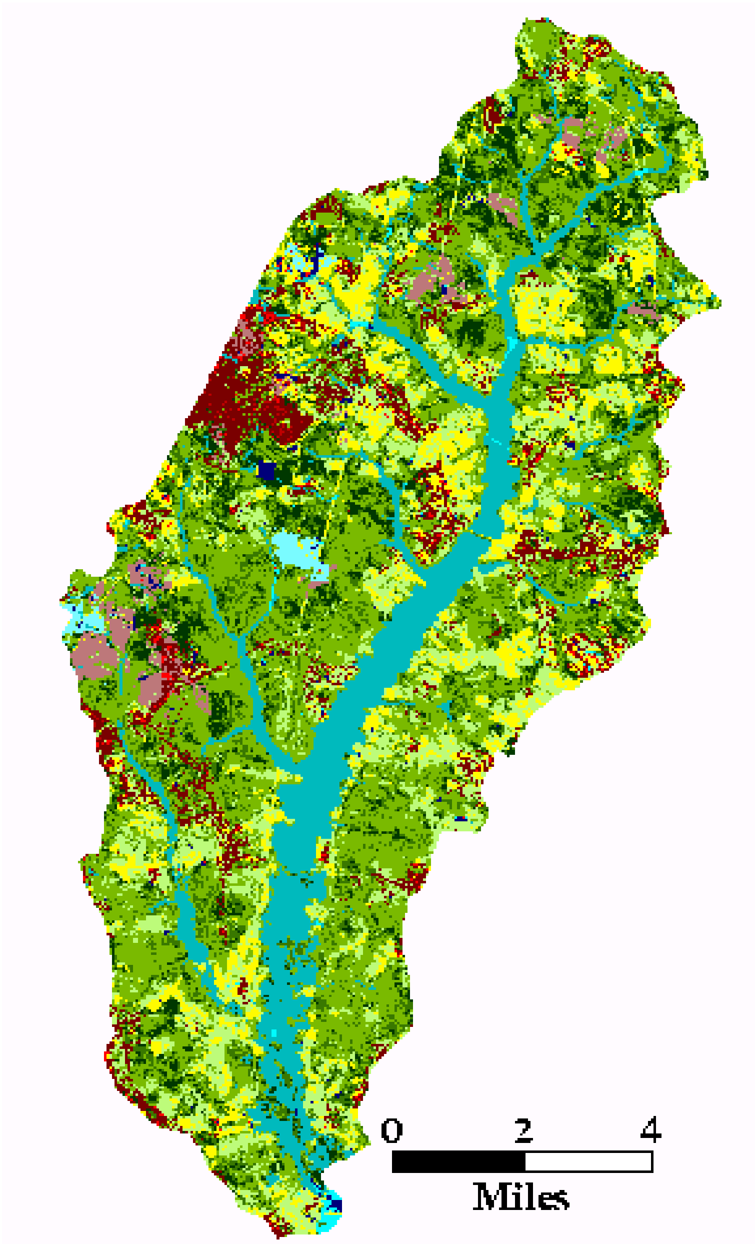
Herpetofauna Present

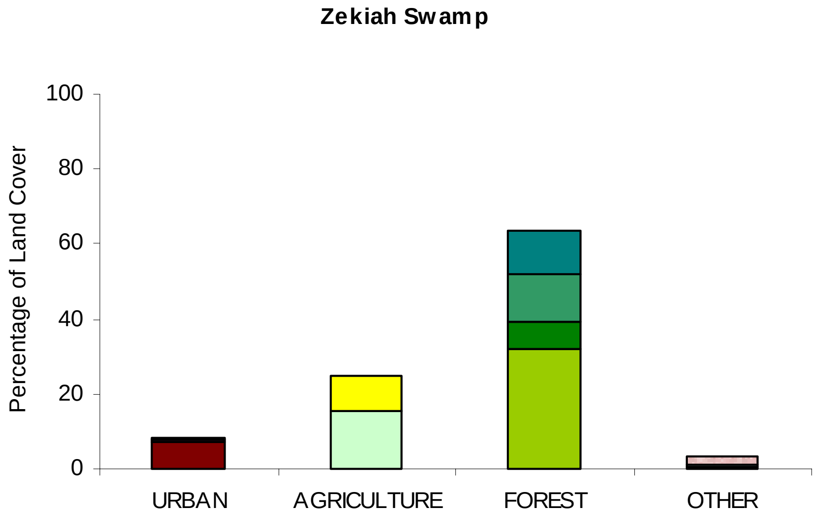
EASTERN GARTER SNAKE
GREEN FROG
MOUNTAIN DUSKY SALAMANDER
NORTHERN DUSKY SALAMANDER
NORTHERN SPRING SALAMANDER
RED SPOTTED NEWT

Zekiah Swamp watershed
MBSS 2001



Zekiah Swamp





Zekiah Swamp

Site Information

Site	Stream Name	12-Digit Subwatershed Code	8-digit Watershed	Basin	County	Date Sampled Spring	Date Sampled Summer	Order	Catchment Area (acres)
ZEKI-103-R-2001	ZEKIAH SWAMP RUN UT4	021401080754	Zekiah Swamp	LOWER POTOMAC RIVER	Charles	08-Mar-01	20-Jun-01	1	112
ZEKI-104-R-2001	ZEKIAH SWAMP RUN UT3	021401080760	Zekiah Swamp	LOWER POTOMAC RIVER	Charles	08-Mar-01	21-Jun-01	1	355
ZEKI-106-R-2001	ZEKIAH SWAMP RUN UT2	021401080760	Zekiah Swamp	LOWER POTOMAC RIVER	Charles	13-Mar-01	25-Jun-01	1	453
ZEKI-109-R-2001	ZEKIAH SWAMP RUN UT2	021401080760	Zekiah Swamp	LOWER POTOMAC RIVER	Charles	13-Mar-01	25-Jun-01	1	899
ZEKI-114-R-2001	ZEKIAH SWAMP RUN UT2	021401080760	Zekiah Swamp	LOWER POTOMAC RIVER	Charles	13-Mar-01	25-Jun-01	1	1039
ZEKI-116-R-2001	WOLF DEN BR UT1	021401080769	Zekiah Swamp	LOWER POTOMAC RIVER	Charles	09-Mar-01	27-Jun-01	1	295
ZEKI-117-R-2001	HERBERT RUN	021401080754	Zekiah Swamp	LOWER POTOMAC RIVER	Charles	08-Mar-01	20-Jun-01	1	398
ZEKI-118-R-2001	BOWLING CR	021401080755	Zekiah Swamp	LOWER POTOMAC RIVER	Charles	07-Mar-01	6-Aug-01	1	248
ZEKI-215-R-2001	ZEKIAH SWAMP RUN UT1	021401080762	Zekiah Swamp	LOWER POTOMAC RIVER	Charles	09-Mar-01	27-Jun-01	2	1490
ZEKI-302-R-2001	ZEKIAH SWAMP RUN	021401080760	Zekiah Swamp	LOWER POTOMAC RIVER	Charles	09-Mar-01	2-Aug-01	3	39411
ZEKI-305-R-2001	ZEKIAH SWAMP RUN	021401080765	Zekiah Swamp	LOWER POTOMAC RIVER	Charles	13-Mar-01	8-Aug-01	3	25890
ZEKI-307-R-2001	ZEKIAH SWAMP RUN	021401080768	Zekiah Swamp	LOWER POTOMAC RIVER	Charles	09-Mar-01	8-Aug-01	3	9445
ZEKI-312-R-2001	ZEKIAH SWAMP RUN	021401080760	Zekiah Swamp	LOWER POTOMAC RIVER	Charles	08-Mar-01	1-Aug-01	3	52936

Indicator Information

Site	FIBI	BIBI	PHI	Brook Trout Present	Black Water Stream
ZEKI-103-R-2001	NR	2.71	32.03	0	0
ZEKI-104-R-2001	3.75	3.86	72.21	0	0
ZEKI-106-R-2001	3.50	3.29	82.80	0	0
ZEKI-109-R-2001	2.75	3.29	63.61	0	0
ZEKI-114-R-2001	3.00	3.86	82.64	0	0
ZEKI-116-R-2001	NR	3.00	81.00	0	0
ZEKI-117-R-2001	3.25	3.29	19.58	0	0
ZEKI-118-R-2001	NR	1.29	5.11	0	0
ZEKI-215-R-2001	4.75	4.14	77.96	0	0
ZEKI-302-R-2001	4.25	3.57	94.80	0	0
ZEKI-305-R-2001	4.25	4.71	92.84	0	0
ZEKI-307-R-2001	4.00	3.86	86.50	0	0
ZEKI-312-R-2001	3.75	3.57	94.75	0	0

Site	Percent Urban	Percent Agriculture	Percent Forest	Percent Other	Percent Impervious Surface
ZEKI-103-R-2001	5.11	33.52	61.36	0.00	1.28
ZEKI-104-R-2001	0.00	6.23	93.77	0.00	0.00
ZEKI-106-R-2001	2.15	46.32	48.89	2.64	0.57
ZEKI-109-R-2001	2.81	42.01	53.82	1.37	0.72
ZEKI-114-R-2001	2.64	41.66	54.49	1.21	0.67
ZEKI-116-R-2001	0.00	12.91	84.20	2.88	0.00
ZEKI-117-R-2001	6.26	42.27	49.80	1.67	2.08
ZEKI-118-R-2001	2.79	58.56	37.01	1.65	1.71
ZEKI-215-R-2001	7.39	35.83	56.72	0.06	2.04
ZEKI-302-R-2001	9.76	28.01	59.46	2.76	3.04
ZEKI-305-R-2001	10.19	27.41	58.98	3.41	3.28
ZEKI-307-R-2001	5.26	17.00	73.04	4.70	1.43
ZEKI-312-R-2001	9.48	24.73	62.78	3.01	2.91

Catchment Land Use Information

Zekiah Swamp

Water Chemistry Information

Site	Closed Ph	Specific Cond.	ANC (µeq/L)	Cl (mg/L)	Nitrate-N (mg/L)	SO4 (mg/L)	T-P (mg/L)	Ortho-P (mg/L)	Nitrite (mg/L)	Ammonia (mg/L)	T-N (mg/L)	DOC (mg/L)	DO (mg/L)	Turbidity (mg/L)
ZEKI-103-R-2001	5.87	79.5	40.1	12.456	0.283	9.009	0.0203	0.005	0.0007	0.018	0.278	1.449	7.2	9.9
ZEKI-104-R-2001	6.64	53.0	129.0	4.147	0.272	7.132	0.0208	0.019	0.0022	0.007	0.299	1.766	8.2	3.6
ZEKI-106-R-2001	6.36	95.7	102.3	8.127	1.783	12.374	0.0253	0.001	0.0098	0.177	2.195	3.349	6.9	6.9
ZEKI-109-R-2001	6.68	86.5	117.6	6.942	1.122	12.425	0.0221	0.003	0.0056	0.028	1.334	2.562	8.2	3.2
ZEKI-114-R-2001	6.63	82.9	121.0	6.426	0.998	12.072	0.0205	0.001	0.0051	0.023	1.210	2.475	8.2	3.2
ZEKI-116-R-2001	4.61	58.1	-25.9	7.374	0.130	6.977	0.0288	0.027	0.0004	0.014	0.170	3.618	7.2	10.9
ZEKI-117-R-2001	6.83	86.9	161.1	9.890	0.397	10.147	0.0936	0.029	0.0054	0.038	0.642	4.690	7.6	20.3
ZEKI-118-R-2001	4.05	2751.5	-172.2	373.208	0.001	797.656	0.0156	0.011	0.0031	0.039	0.282	3.290	0.4	2.7
ZEKI-215-R-2001	6.66	89.5	127.8	7.610	0.926	13.173	0.0132	0.011	0.0014	0.017	1.162	1.824	7.6	5.5
ZEKI-302-R-2001	6.11	169.4	104.2	33.607	0.320	11.180	0.0187	0.008	0.0020	0.009	0.453	3.581	7.5	8.9
ZEKI-305-R-2001	6.55	173.3	72.9	36.180	0.356	10.359	0.0260	0.001	0.0031	0.011	0.483	4.606	6.1	9.2
ZEKI-307-R-2001	6.12	72.1	42.9	9.657	0.307	8.668	0.0121	0.005	0.0009	0.032	0.400	3.572	5.6	6.3
ZEKI-312-R-2001	6.73	163.2	87.3	34.167	0.246	10.686	0.0221	0.015	0.0017	0.002	0.331	3.740	7.3	10.5

Physical Habitat Condition

Site	Riparian Buffer Width Left	Riparian Buffer Width Right	Adjacent Cover Left	Adjacent Cover Right	Instream Habitat Structure	Epifaunal Substrate	Velocity/ Depth Diversity	Pool/ Glide/ Eddy Quality	Extent of Pools (m)	Riffle/ Run Quality	Extent of Riffles (m)	Embed-dedness	Shading	Trash Rating	Maximum Depth (cm)
ZEKI-103-R-2001	20	20	CP	CP	12	9	7	7	60	5	22	65	96	15	22
ZEKI-104-R-2001	50	50	FR	FR	16	17	10	9	25	15	65	15	75	16	32
ZEKI-106-R-2001	50	50	FR	FR	11	11	12	14	45	12	31	25	88	16	78
ZEKI-109-R-2001	50	50	OF	FR	14	10	9	8	35	14	60	35	94	18	46
ZEKI-114-R-2001	45	35	CP	CP	15	10	12	13	19	15	59	20	95	14	52
ZEKI-116-R-2001	50	50	FR	FR	18	16	10	10	47	12	30	10	99	18	32
ZEKI-117-R-2001	50	50	FR	FR	6	7	8	7	25	15	75	100	98	17	37
ZEKI-118-R-2001	50	50	FR	OF	4	5	2	3	75	0	0	100	65	18	15
ZEKI-215-R-2001	50	50	FR	FR	8	4	12	13	62	11	15	15	90	10	110
ZEKI-302-R-2001	50	50	FR	FR	19	17	15	15	75	16	70	30	85	16	84
ZEKI-305-R-2001	50	50	FR	FR	16	15	14	15	70	14	20	40	84	15	108
ZEKI-307-R-2001	50	50	FR	FR	15	15	13	15	75	12	20	75	63	14	104
ZEKI-312-R-2001	50	50	FR	FR	19	18	15	15	75	16	70	30	85	18	73

Interpretation of Watershed Condition

- Low ANC values may be indicative of natural conditions due to geology and swampy habitat
- Chloride values elevated at some sites; extremely high at site 118
- Phosphorous values elevated at most sites
- Physical habitat parameters are generally good
- Recent logging adjacent to sites 104 and 106
- Many streams are braided

Zekiah Swamp

Physical Habitat Modifications

Site	Buffer Breaks?	Surface Mine?	Landfill?	Channelization?	Erosion Severity Left	Erosion Severity Right	Bar Formation
ZEKI-103-R-2001	N	N	N	N	Mild	Mild	Minor
ZEKI-104-R-2001	N	N	N	N	Moderate	Moderate	Moderate
ZEKI-106-R-2001	Y	N	N	N	Moderate	Moderate	Extensive
ZEKI-109-R-2001	N	N	N	N	Mild	Mild	Moderate
ZEKI-114-R-2001	N	N	N	N	Severe	Severe	Severe
ZEKI-116-R-2001	Y	N	N	Y	Mild	None	Minor
ZEKI-117-R-2001	N	N	N	N	Mild	Mild	Minor
ZEKI-118-R-2001	N	N	N	N	None	None	None
ZEKI-215-R-2001	N	N	N	N	Moderate	Moderate	Minor
ZEKI-302-R-2001	N	N	N	Y	None	None	Minor
ZEKI-305-R-2001	N	N	N	N	Moderate	Moderate	Minor
ZEKI-307-R-2001	N	N	N	N	None	None	None
ZEKI-312-R-2001	N	N	N	N	None	None	Minor

Stream Waders Data

Site	8-Digit Watershed	12-Digit Subwatershed	Stream name	Benthic IBI
0769-4	Zekiah Swamp	021401080769	WOLF DEN BR	2.43
0768-1	Zekiah Swamp	021401080768	ZEKIAH SWAMP RUN UT	2.43
0768-5	Zekiah Swamp	021401080768	ZEKIAH SWAMP RUN UT	2.14
0765-1	Zekiah Swamp	021401080765	ZEKIAH SWAMP RUN	4.14
0769-3	Zekiah Swamp	021401080769	ZEKIAH SWAMP RUN	3.29
0769-5	Zekiah Swamp	021401080769	ZEKIAH SWAMP RUN	2.71
0767-1	Zekiah Swamp	021401080767	MILL DAM RUN	3.86
0768-2	Zekiah Swamp	021401080768	ZEKIAH SWAMP RUN UT	3.00
0768-3	Zekiah Swamp	021401080768	ZEKIAH SWAMP RUN UT	4.14
0768-4	Zekiah Swamp	021401080768	DEVILS NEST	1.57
0767-4	Zekiah Swamp	021401080767	MILL DAM RUN UT	3.00
0762-4	Zekiah Swamp	021401080762	ZEKIAH SWAMP RUN UT	4.14
0766-5	Zekiah Swamp	021401080766	JORDAN SWAMP RUN UT	1.29
0762-1	Zekiah Swamp	021401080762	ZEKIAH SWAMP RUN UT	4.71
0764-5	Zekiah Swamp	021401080764	PINEY BR UT	3.29
0767-5	Zekiah Swamp	021401080767	ZEKIAH SWAMP RUN UT	4.43
0764-1	Zekiah Swamp	021401080764	PINEY BR	3.29
0766-3	Zekiah Swamp	021401080766		2.14
0767-2	Zekiah Swamp	021401080767	MILL DAM RUN UT	3.57
0765-3	Zekiah Swamp	021401080765	ZEKIAH SWAMP RUN UT	2.71
0769-1	Zekiah Swamp	021401080769	WOLF DEN BR	4.43
0769-2	Zekiah Swamp	021401080769	WOLF DEN BR UT	2.71
0767-3	Zekiah Swamp	021401080767	MILL DAM RUN UT	2.43
0765-2	Zekiah Swamp	021401080765	ZEKIAH SWAMP RUN UT	2.14
0766-4	Zekiah Swamp	021401080766	JORDAN SWAMP RUN	4.43
0764-4	Zekiah Swamp	021401080764	PINEY BR UT	2.14

Zekiah Swamp

Site	8-Digit Watershed	12-Digit Subwatershed	Stream name	Benthic IBI
0766-2	Zekiah Swamp	021401080766	JORDAN SWAMP RUN UT	1.86
0762-2	Zekiah Swamp	021401080762	ZEKIAH SWAMP RUN UT	2.71
0759-3	Zekiah Swamp	021401080759	CLARK RUN	3.00
0760-3	Zekiah Swamp	021401080760		4.14
0762-3	Zekiah Swamp	021401080762	ZEKIAH SWAMP RUN UT	3.29
0761-4	Zekiah Swamp	021401080761	KERRICK SWAMP RUN	1.57
0764-2	Zekiah Swamp	021401080764	PINEY BR UT	3.29
0764-3	Zekiah Swamp	021401080764	PINEY BR	1.29
0754-3	Zekiah Swamp	021401080754	RICE CR	4.43
0758-1	Zekiah Swamp	021401080758	BOWMAN CR	3.57
0766-1	Zekiah Swamp	021401080766	JORDAN SWAMP	1.29
0757-1	Zekiah Swamp	021401080757	MADDOX BR	4.14
0761-2	Zekiah Swamp	021401080761	KERRICK SWAMP RUN	1.57
0760-1	Zekiah Swamp	021401080760	ZEKIAH SWAMP UT	4.43
0758-2	Zekiah Swamp	021401080758	BOWMAN CR	3.86
0756-2	Zekiah Swamp	021401080756	ROSS BR	4.71
0756-1	Zekiah Swamp	021401080756	ROSS BR	4.14
0760-2	Zekiah Swamp	021401080760	STONER CR	4.71
0758-5	Zekiah Swamp	021401080758	BOWMAN CR UT	4.14
0758-3	Zekiah Swamp	021401080758	BOWMAN CR	4.43
0754-2	Zekiah Swamp	021401080754	COOKSEY RUN	4.14
0761-3	Zekiah Swamp	021401080761	KERRICK SWAMP RUN UT	3.57
0754-1	Zekiah Swamp	021401080754	JAMES RUN	4.71
0757-4	Zekiah Swamp	021401080757	MADDOX BR	1.86
0755-4	Zekiah Swamp	021401080755	ZEKIAH SWAMP RUN	4.14
0758-4	Zekiah Swamp	021401080758	BOWMAN CR	4.71
0761-5	Zekiah Swamp	021401080761	KERRICK SWAMP RUN	1.00
0760-4	Zekiah Swamp	021401080760	ZEKIAH SWAMP RUN	4.14
0761-1	Zekiah Swamp	021401080761	KERRICK SWAMP	4.43
0755-2	Zekiah Swamp	021401080755	MUD CR	3.00
0757-2	Zekiah Swamp	021401080757	MADDOX BR UT	5.00
0756-3	Zekiah Swamp	021401080756	ROSS BR	4.43
0756-4	Zekiah Swamp	021401080756	ROSS BR	4.14
0755-5	Zekiah Swamp	021401080755	BOWLING CR	1.86
0759-4	Zekiah Swamp	021401080759	CLARK RUN	3.86
0757-3	Zekiah Swamp	021401080757	MADDOX BR UT	4.71
0755-1	Zekiah Swamp	021401080755	BOWLING CR UT	3.86
0755-3	Zekiah Swamp	021401080755	ZEKIAH SWAMP RUN UT	3.00
0754-5	Zekiah Swamp	021401080754	CLARK RUN	3.29
0759-1	Zekiah Swamp	021401080759	CLARK RUN UT	4.43
0759-2	Zekiah Swamp	021401080759	CLARK RUN	4.43
0754-4	Zekiah Swamp	021401080754	SCAR BR	3.00

Zekiah Swamp

Fish Species Present

AMERICAN EEL
BLACKNOSE DACE
BLUEGILL
BLUESPOTTED SUNFISH
BROWN BULLHEAD
CHAIN PICKEREL
CREEK CHUBSUCKER
EASTERN MUDMINNOW
FALLFISH
FLIER
GOLDEN SHINER
GREEN SUNFISH
IRONCOLOR SHINER
LARGEMOUTH BASS
LEAST BROOK LAMPREY
LEPOMIS HYBRID
MARGINED MADTOM
MOSQUITOFISH
PIRATE PERCH
PUMPKINSEED
REDFIN PICKEREL
ROSYSIDE DACE
SEA LAMPREY
SWAMP DARTER
TADPOLE MADTOM
TESSELLATED DARTER
WARMOUTH
WHITE SUCKER
YELLOW PERCH

Exotic Plants Present

JAPANESE HONEYSUCKLE
MULTIFLORA ROSE
MILE-A-MINUTE
MICROSTEGIUM
PHRAGMITES

Benthic Taxa Present

ABLABESMYIA
ACERPENNA
AEDES
ALLOCAPNIA
AMPHINEMURA
BAETIDAE
BEZZIA
BOYERIA
BRILLIA
CAECIDOTEA
CALOPTERYX
CAPNIIDAE
CERATOPOGON
CHEUMATOPSYCHE
CHIRONOMINI
CHIRONOMUS
CHLOROPERLIDAE
CHRYSOPS
CLINOTANYPUS
CLIOPERLA
CONCHAPELOPIA
CORBICULA
CORYNONEURA
CRANGONYX
CRICOTOPUS
CRICOTOPUS/ORTHOCLADIUS
CRYPTOCHIRONOMUS
CULICOIDES
CURA
CYPHON
DIPLECTRONA
DIPLOCLADIUS
DYTISCIDAE
ECCOPTURA
EPHEMERELLA
EUKIEFFERIELLA
EURYLOPHELLA
FERRISSIA
GAMMARUS
GOMPHIDAE
GORDIIDAE
HELENIELLA
HEMERODROMIA
HEPTAGENIIDAE
HEXATOMA
HYDATOPHYLAX
HYDROBAENUS
HYDROPSYCHE
HYDROPSYCHIDAE
ISOPERLA
ISOTOMURUS
LARSIA
LEPTOCERIDAE
LEPTOPHLEBIIDAE
LEUCTRA
LEUCTRIDAE
LIMNEPHILIDAE
LIMNOPHYES
LUMBRICULIDAE
LYPE
MACRONYCHUS
MEROPELOPIA
MICROPSECTRA
MICROTENDIPES
MOLANNODES
NANOCLADIUS
NEMOURIDAE
NEOPHYLAX
NIGRONIA
OPTIOSERVUS
ORTHOCLADIINAE
ORTHOCLADIINAE A
OULIMNIUS
PARAKIEFFERIELLA
PARAMETRIOCNEMUS
PERLIDAE
PERLODIDAE
PHAENOPSECTRA
PHYLOCENTROPUS
PHYSELLA
PLECOPTERA
POLYCENTROPODIDAE
POLYPEDILUM
PROBEZZIA
PROCLADIUS
PROSIMULIUM
PSEUDOLIMNOPHILA
PSILOTRETA
PTILOSTOMIS
PYCNOPSYCHE
RHEOCRICOTOPUS
RHEOTANYTARSUS
RHYACOPHILA
SIMULIUM
SIPHLOPLECTRON
SPHAERIIDAE
SPIROSPERMA
STEGOPTERNA
STEMPELLINELLA
STENELMIS
STENONEMA
STROPHOPTERYX
STYLOGOMPHUS
SYMPOSIOCLADIUS
SYMPOTTHASTIA
SYNURELLA
TAENIOPTERYGIDAE
TAENIOPTERYX
TANYTARSINI
TANYTARSUS
THIENEMANNIELLA
TIPULA
TRIAENODES
TRIBELOS
TRISSOPELOPIA
TUBIFICIDAE
TVETENIA
XYLOTOPUS
ZAVRELIMYIA

Herpetofauna Present

AMERICAN TOAD
BLACK RAT SNAKE
BULLFROG
COMMON MUSK TURTLE
COMMON SNAPPING TURTLE
EASTERN BOX TURTLE
EASTERN PAINTED TURTLE
FIVE-LINED SKINK
FOWLER'S TOAD
GRAY TREEFROG
GREEN FROG
NORTHERN BLACK RACER
NORTHERN RINGNECK SNAKE
NORTHERN TWO-LINED SALAMANDER
NORTHERN WATER SNAKE
PICKEREL FROG
ROUGH GREEN SNAKE
SOUTHERN LEOPARD FROG
SPOTTED TURTLE
WOOD FROG

5 TEMPORAL CHANGES IN PARAMETER ESTIMATES FOR 8-DIGIT WATERSHEDS

As each round of statewide sampling by the MBSS (or the Survey) is conducted at regular intervals over time, temporal changes (trends) in the stream condition statewide and for individual 8-digit watersheds can be evaluated. Such monitoring data are necessary to assessing whether implementation of Total Maximum Daily Loadings (TMDLs) and other restoration measures are effective in achieving or maintaining water quality standards (or in effecting other improvements in stream quality). The MBSS also provides information on physical parameters that can be used to track changes in habitat conditions and link such changes to trends in water quality. While these comparisons may be useful, it is important to remember that methods were often different in the first round than in the second.

This chapter compares results for the second year of MBSS Round Two with data from Round One (1995-1997). Six of the 8-digit watersheds sampled in 2001 also had more than 10 spring samples in one or two years of MBSS Round One. Data from two or three years are insufficient to estimate trends, but can be used to assess differences. The mean fish and benthic IBI scores were estimated as well as the percentage of stream miles with fish or benthic IBI scoring less than 3 for each year, along with the 90% confidence intervals. The combined IBI was not employed in the interannual variability analysis because comparisons could have obscured real differences apparent in individual fish or benthic IBIs. In general, the mean IBI scores were stable over time within the range of variablitity observed around the mean IBI scores (Table 5-1). Only one watershed, Deer Creek, showed variation in IBI scores between years. The mean benthic IBI in Round 1 was 3.62 with a lower 90% confidence limit of 3.31 and an upper confidence limit of 3.81. In 2001, the mean benthic IBI in this watershed was 4.17 with a lower confidence limit of 3.93 and an upper confidence limit of 4.31Sa statistically significant increase.

The yearly estimated confidence intervals for percentage of stream miles with fish or benthic IBI scores less than 3 overlapped for all watersheds except for Seneca Creek which had an interval estimate of 4.6 to 60 % for the fish IBI in 2001 as compared to the 0 to 3.7% interval in Round 1, suggesting that stream health improved (Table 5-2).

Table 5-1. Variability in mean fish and benthic IBI scores between the 1995-1997 MBSS and the 2001 MBSS. Watersheds shown are those that contained 10 or more sites in the 1995-1997 MBSS.

Watershed	FIBI	Lower 90%	Upper 90%	BIBI	Lower 90%	Upper 90%
Deer Creek 1997	3.68	2.15	4.61	3.62	3.31	3.81
Deer Creek 2001	3.75	3.36	3.99	4.17	3.93	4.31
Seneca Creek 1997	3.92	2.46	4.80	2.98	2.06	3.54
Seneca Creek 2001	3.33	2.73	3.70	2.82	2.46	3.04
Upper Pocomoke River 1997	3.20	0.74	4.70	1.96	1.25	2.39
Upper Pocomoke River 2001	3.02	2.59	3.28	2.32	2.02	2.51
Western Branch 1997	2.60	1.29	3.40	2.19	1.44	2.65
Western Branch 2001	3.78	3.21	4.13	2.43	2.21	2.57
Youghiogheny River 1995	3.21	1.62	4.18	3.78	2.89	4.32
Youghiogheny River 1997	3.22	1.97	3.98	3.65	2.80	4.17
Youghiogheny River 2001	2.96	2.39	3.31	3.58	3.15	3.85
Zekiah Swamp 1995	3.86	2.27	4.83	3.14	2.60	3.47
Zekiah Swamp 2001	3.73	3.41	3.93	3.42	3.05	3.65

Table 5-2. Variability in the percentage of fish and benthic IBI scores < 3 between the 1995-1997 MBSS and the 2001 MBSS. Watersheds shown are those that contained 10 or more sites in the 1995-1997 MBSS.						
Watershed	**Percentage of Stream Miles with FIBI < 3**	**Lower 90%**	**Upper 90%**	**Percentage of Stream Miles with BIBI < 3**	**Lower 90%**	**Upper 90%**
Deer Creek 1997	30.18	8.09	52.27	2.90	0.17	5.63
Deer Creek 2001	9.09	0.47	36.44	9.09	0.47	36.44
Seneca Creek 1997	1.64	0.00	3.73	38.36	21.21	55.51
Seneca Creek 2001	25.00	4.64	59.97	50.00	19.29	80.71
Upper Pocomoke River 1997	18.79	0.00	42.88	87.62	48.78	100.00
Upper Pocomoke River 2001	36.36	13.51	65.02	81.82	52.99	96.67
Western Branch 1997	37.61	8.03	67.19	93.38	67.98	100.00
Western Branch 2001	25.00	4.64	59.97	87.50	52.93	99.36
Youghiogheny River 1995	24.90	5.07	44.73	7.53	3.17	11.89
Youghiogheny River 1997	21.44	7.19	35.69	14.29	1.94	26.64
Youghiogheny River 2001	30.77	11.27	57.26	30.77	11.27	57.26
Zekiah Swamp 1995	12.02	0.00	27.39	43.87	24.79	62.95
Zekiah Swamp 2001	10.00	0.51	39.42	0.00	0.00	25.89

The percentage of stream miles with certain physical habitat characteristics was also estimated. Specifically, the percentages of stream miles with the following were compared:

- Physical Habitat Index (PHI) < 42 (poor to very poor)
- No riparian buffer

The interval estimates for these parameters were used to "ground truth" results from the two rounds of MBSS. These parameters would generally be subject to minimal changes over a few years, but will be important for tracking long-term changes in stream habitat. Bear in mind, that any observed changes could result from the selection of different random sampling sites, rather than to real differences between years.

In general, the interval estimates for these habitat parameters overlap across years, as would be expected (Table 5-3). Significant differences between years were observed for in one watershed. For the percentage of stream miles with PHI < 42, 1997 estimates were significantly higher in the Youghiogheny River than they were in 2001. This result suggest that the samples in the two years were located in markedly different streams habitats by chance, and are not likely to reflect real changes in habitat between the years, especially since the estimate for the Youghiogheny River in 1995 was not significantly different from either the 1997 or 2001 sampling. For 90% confidence intervals, the true percentage of stream miles would be outside the interval estimate in 10% of the cases. Thus, when a large number of comparisons are made, as for this report, some false positives are expected.

The physical habitat for the sites sampled influence the fish and benthic communities. Hence, when comparing estimates of percentage of stream miles with IBI < 3 across years, it is important to evaluate whether the samples were collected in similar habitats. On average, simple random sampling results in the number of sites in each habitat class being proportional to the fraction of streams having that habitat. However, any individual selection of sites could, by chance, result in a higher sampling density in one habitat, especially for low sample sizes.

The detection of trends in mean IBI scores statewide, or for individual watersheds requires a time series of data. Although exact statistics can be obtained for $\geq$ 2 years, a minimum of four or more rounds of samples collected over time is required to obtain meaningful results using the non-parametric Mann-Kendall test for trends (Gilbert 1987, Hirsch et al. 1982). While it is true that evaluating some fixed sites that are stable in terms of land use and other stressors would ideally provide additional information on year-to-year variabilities across a wide range of conditions, resources were not available for this type of supplemental effort during the 2001 sampling year.

Table 5-3. Variability in certain physical habitat parameters between the 1995-1997 MBSS and the 2001 MBSS. Watersheds shown are those that contained 10 or more sites in the 1995-1997 MBSS						
Watershed	**Percentage of Stream Miles with PHI < 42**	**Lower 90%**	**Upper 90%**	**Percentage of Stream Miles with No Riparian Buffer**	**Lower 90%**	**Upper 90%**
Deer Creek 1997	26.50	0.00	54.40	17.90	0.00	40.04
Deer Creek 2001	18.18	3.33	47.01	7.14	0.37	29.67
Seneca Creek 1997	50.50	27.70	73.30	22.50	3.31	41.69
Seneca Creek 2001	12.50	0.64	47.07	20.00	5.68	43.98
Upper Pocomoke River 1997	37.70	0.00	81.65	41.50	1.48	87.52
Upper Pocomoke River 2001	45.45	19.96	72.88	30.77	11.27	57.26
Western Branch 1997	66.30	27.27	100.00	28.60	0.00	60.91
Western Branch 2001	12.50	0.64	47.07	0.00	0.00	25.89
Youghiogheny River 1995	61.50	25.42	97.58	26.70	0.95	52.45
Youghiogheny River 1997	73.70	49.92	97.48	27.50	8.48	46.52
Youghiogheny River 2001	7.69	0.39	31.63	6.25	0.32	26.40
Zekiah Swamp 1995	41.20	12.66	69.74	14.80	0.00	34.97
Zekiah Swamp 2001	10.00	0.51	39.42	0.00	0.00	50.58

6. SENTINEL SITES

Round Two of the Survey provides an opportunity to examine trends in stream conditions over time. However, to accurately assess temporal trends, it is necessary to differentiate between changes that result from anthropogenic influences and those that result from natural variation. The Maryland Biological Stream Survey (MBSS or the Survey) is monitoring annually a network of high quality reference sites, known as Sentinel sites, to aid in assessing natural year-to-year variability in stream conditions.

In natural streams, variability in ecological condition among years should be attributable only to variations in precipitation and temperature regimes, as well as to biotic interactions among native species. Therefore, annual monitoring information from minimally disturbed sites in locations not likely to experience future anthropogenic disturbance (i.e., Sentinel sites) offers the best means of interpreting the degree to which changes in biological indicator scores result from natural variability. Understanding the variability of disturbed sites is also important for evaluating status and trends. However, assuring that stressor conditions do not change at disturbed sites over time is more problematic. The Survey is not currently sampling fixed disturbed sites.

Although there are no longer any pristine streams in Maryland, monitoring a set of the best remaining streams offers a reasonable alternative for evaluating natural variability. During 2000, the Survey established the Sentinel Site network. In 2001, the Survey continued annual sampling at a set of Sentinel sites. The following sections describe the methods used to select Sentinel sites and presents the results of the Sentinel site sampling in 2001.

6.1 METHODS

To ensure that sites with minimal anthropogenic impacts were selected as long-term Sentinel sites, a three-tier framework of land use, water quality, and biological community criteria was established and applied to all sites sampled by the MBSS from 1995 to 1999. The following Tier 1 criteria were used to identify candidate Sentinel sites:

- No evidence of acid mine drainage in the site catchment
- Sulfate < 50 mg/l
- pH > 6.0 or DOC > 8.0 mg/l (i.e., pH could be < 6 if the stream is a naturally acidic blackwater)
- Nitrate nitrogen < 4.0 mg/l
- Percent forested land use > 50% of catchment area
- Combined Biotic Index (CBI, calculated as the simple mean of FIBI and BIBI scores) > 3.0, or coldwater or blackwater stream

In addition, streams not previously sampled quantitatively by MBSS, but likely to meet the above criteria, were included in the initial pool of candidate sites.

Candidate Sentinel sites were grouped according to stream order and geographic region (Coastal Plain-Eastern Shore, Coastal Plain-Western Shore, Eastern Piedmont, or Highlands) to facilitate representation of small, medium, and large streams throughout Maryland. Criteria were also applied to ensure that the candidate sites were likely to remain minimally disturbed for the foreseeable future. The Tier 2 list of provisional sites was compiled using the following criteria:

- minimum of 5 sites in each geographic region
- minimum of 5 sites in each stream order
- a large amount of the catchment located within protected lands (e.g., The Nature Conservancy Preserves and State Forests), and
- sampling site itself located on public land.

Therefore, the provisional Sentinel sites consisted of six or seven sites in each of the four geographic regions that appeared to have the least human disturbance and the least likelihood of changing in the future from human-related activities in their catchments. To compile the final Tier 3 selected Sentinel sites, biologists reviewed information from external sources and conducted site visits (when needed to confirm land use or other watershed conditions).

6.2 SITES SELECTED

Prior to the 2000 MBSS sampling season, 27 sites were selected for the Sentinel site network using the three-tiered process based on the land use, water quality, and biological community criteria described above (Appendix Table D-1). These sites were either selected from sites sampled during Round One of the Survey, or from streams with existing ecological and land use information warranting their inclusion.

The 2000 Sentinel site network was reviewed for potential changes in light of the 2000 sampling results and a slightly modified group was selected for sampling in 2001. Based on sample results from 2000, 24 of the 27 Sentinel sites continued to meet the minimum Sentinel site criteria. NASS-301-S-2000 was excluded from the Sentinel site network because forested land use did not exceed 50% (42% forested land use). Two additional sites (WCHE-086-S-2000 and WYER-118-S-2000) were flagged for possible exclusion because the Combined Biotic Index (CBI) score in 2000 did not exceed 3.0 (and these sites were not coldwater or blackwater streams).

Of the 294 sites sampled by the Survey in 2000 (including the 27 Sentinel sites), 91 met the criteria used to identify candidate Sentinel sites (12 in Coastal Plain-Eastern Shore, 20 Coastal Plain-Western Shore, 18 Eastern Piedmont, and 41 Highlands) (Appendix Table D-2). To ensure that adequate numbers of Sentinel sites are available in each geographic region, new sites sampled in 2000 that met the candidate criteria were considered as potential substitutes for excluded Sentinel sites. Site STMA-104-R-2000 was proposed as a future replacement for Site WCHE-086-S-2000 (Coastal Plain-Western Shore). Site STMA-104-R-2000 is located on Warehouse Run in Saint Mary's County, a stream that has excellent water quality conditions, high biological index scores, and a catchment dominated by forested land use. Located on Kirby Creek in Queen Anne's County, site CORS-102-R-2000, a blackwater stream with good water quality and a catchment dominated by forested land use, was proposed as a future replacement for WYER-118-S-2000 (Coastal Plain-Eastern Shore; Appendix Table D-2). Because NASS-301-S-2000 was located on a minimally disturbed, blackwater stream, a replacement site (NASS-302-S-20010) was selected downstream in the watershed so that the percent forested land use would meet the minimum criterion. In addition, although JONE-322-S-2000, LOCH-102-S-2000, and LOCH-209-S-2000 (Eastern Piedmont) met the minimum Sentinel site criteria based on sampled results in 2000, additional information revealed anthropogenic impacts that indicated they should not be included in the Sentinel site network. At the same time, FURN-101-C-2000 and LIBE-102-C-2000 were selected as new Sentinel sites. Both of these sites are located on streams that have excellent water quality with catchments dominated by forested land use (Appendix Table D-1). After these changes were made to the Sentinel site network, 26 sites were designated for sampling in 2001 (Appendix Table D-3).

Of the 256 sites sampled by the Survey in 2001 (including the 26 Sentinel sites), 76 met the criteria used to identify candidate Sentinel sites (Appendix Table D-4). Of the 26 Sentinel sites, 25 continued to meet the minimum Sentinel site criteria after being sampled in 2001. Site WCHE-086-S-2001 did not meet criteria because the Combined Biotic Index score in 2001 was less than 3.00 (and the site is not located on a coldwater or blackwater stream). Because this site has not met the Sentinel site criteria for two consecutive years, site PAXM-106-R-2001 is being considered as a potential future replacement. This alternative site is located on an unnamed tributary to Mataponi Creek in Prince George's County, and has good water quality and a CBI score that exceeds 4.00. This site will be used in 2003 if site WCHE-086-S-2001 again fails to meet Sentinel site criteria in 2002. In future years, it is possible that other Sentinel sites may be replaced and others added to ensure that adequate numbers of minimally disturbed sites are available to detect temporal trends in natural stream conditions.

6.3 INTERANNUAL VARIABILITY AT SENTINEL SITES

The Combined Biotic Index, which rates the health of a stream based on both benthic and fish communities, can be used as a tool to document temporal trends that result from natural variations. Although only three years of data currently exist for many of the Sentinel sites, we examined the variability in the CBI over this period. Approximately 82% of the CBI scores for each Sentinel site varied by less than 1.0. Variability in the CBI was negligible for the Highland region (average range of CBI was 0.37 per site, maximum of 0.68), whereas the greatest variability in the CBI occurred for the Coastal Plain-Eastern Shore region (average of 0.71, maximum of 1.27). The maximum range in the CBI (1.27) occurred at NASS-108-S. Most of the variability in the index for this site can be attributed to changes in the Fish IBI scores (benthic IBI scores were very similar among years), which went from a Fair rating in 1997 to a Poor rating in both 2000 and 2001. The absence of three native fish species in 2000 and 2001 contributed to the lower FIBI scores in these two years. These analyses of the Sentinel network indicate that stream conditions did not fluctuate much over three years as the result of natural variations. However, it will likely take more years of data from the Sentinel site network to accurately document temporal variability associated with natural influences.

Although the years in which data were collected at each Sentinel site varied (1995, 1996, 1997, 2000, or 2001), values for most of the parameters assessed were not dramatically different between years (Appendix Table D-5). The most notable changes included variations in the blackwater or brook trout designation for a site. For example, site JONE-109-S-2001 underwent changes in brook trout designation, based on the presence of brook trout in the sample one year and their absence in the other year. In 2001, brook trout were not collected in the actual site, but qualitative sampling 20 meters downstream illustrated that brook trout are still present in this stream.

These changes in designation indicate that it is important to consider other available data in assigning coldwater or blackwater designations. For example, the use of temperature logger records will likely prove more reliable for identifying coldwater streams than relying on the capture of a single fish species (This method should identify historically coldwater streams from which trout have been extirpated for reasons other than temperature). In addition, field observations and site-specific knowledge regarding blackwater conditions can augment that strictly water-chemistry based definition, which uses single-point-in-time data that do not capture natural variations in DOC, pH or ANC levels.

6.4 DISCUSSION

The existing Sentinel site network contains some of the best freshwater streams in Maryland (i.e., minimally disturbed and least likely to change in the future from human-related activities) and includes first- through third-order streams within each geographic region. However, noticeable differences exist in the quality of these best streams in each of the four geographic regions. The Highlands stratum contains seven streams with no apparent anthropogenic impacts. All seven have excellent water quality conditions, good biological index scores, and a catchment dominated by forested land use (76% or greater; Appendix Table D-5). Conversely, it was difficult to identify sites of comparable quality in the Coastal Plain-Western Shore, Eastern Piedmont, and especially the Coastal Plain-Eastern Shore. Although a number of sites in these regions met the minimum criteria for candidate Sentinel sites, few were truly excellent. Frequently anthropogenic impacts (mostly resulting from agricultural land use) were present to some degree. Therefore, it is important to maintain adequate numbers of Sentinel sites in all Maryland regions, while recognizing that the quality of sites varies among regions.

Nonetheless, the Survey's sentinel site network is a valuable tool for interpreting stream conditions over time and informing water resources management. One potential use would be to adjust individual site fish and benthic IBI scores relative to the scores obtained at the Sentinel sites. For example, in years where Sentinel site scores were consistently low (as a result of natural variation such as drought and low flow conditions), random sites sampled that year would have their scores adjusted upward by the amount the Sentinel site were lower than normal. Raw scores would be retained for most analyses, but adjusted scores could be used in water resources management to provide fair assessments across watersheds sampled in different years. These adjustments will be undertaken at the end of the five-year Round Two sampling, when a more accurate picture of natural variability should arise. In general, Sentinel IBI scores increased slightly from 2000 to 2001, but attribution of this change to natural factors is not yet possible.

Ultimately, the utility of the Sentinel network will depend upon whether land use changes or other impacts arise in a significant number of Sentinel site catchments, thereby reducing the ability of the network to define natural variability. Future sampling will determine whether high quality conditions continue at the locations included in the Sentinel site network. As needed, Sentinel sites may be replaced to ensure that adequate numbers of undisturbed sites are available in each geographic region. We hope that after several years, the Sentinel site network will provide an accurate picture of the temporal variability in the best remaining streams in Maryland.

7 MANAGEMENT IMPLICATIONS AND FUTURE DIRECTIONS

The goal of the Maryland Biological Stream Survey (MBSS or Survey) is to provide natural resource managers, policy-makers, and the public with the information they need to make effective natural resource decisions about the State's non-tidal streams and the watersheds they drain. For this reason, the Survey was designed to answer a set of 64 management questions. In the Round One report (Roth et al. 1999), many of these questions were answered, while some remained unanswered and new questions were raised. Many of the answers were the first scientifically defensible and management-relevant answers obtained for these questions.

By the end of Round One, it was apparent that certain management concerns had changed and programmatic needs were evolving. The changes instituted in Round Two were designed to address this changing management context without losing comparability with Round One data. This chapter focuses on the management implications of the results obtained in 2001, recognizing that this sampling year is only one of five and that many questions will only be answered after Round Two is completed. In addition to implications of the core survey results, this chapter discusses the future sampling and monitoring/assessment activities planned for Round Two and beyond.

7.1 MANAGEMENT IMPLICATIONS

Information from Round One of the Survey is being heavily used to support management and policy initiatives at DNR. Results from sampling in Round Two will be used to help refine answers to the MBSS questions and to address new issues that arise. In addition to serving DNR's program needs, a number of other agencies and institutions have an interest in the Survey's answers to its primary objectives:

- assess the current status of biological resources in Maryland's non-tidal streams;
- quantify the extent to which acidic deposition has affected or may be affecting biological resources in the state;
- examine which other water chemistry, physical habitat, and land use factors are important in explaining the current status of biological resources in streams;
- provide a statewide inventory of stream biota;
- establish a benchmark for long-term monitoring of trends in these biological resources; and
- target future local-scale assessments and mitigation measures needed to restore degraded biological resources.

Chesapeake Bay Agreement. The information being obtained by the Survey is expected to be highly useful for the new stream corridor goals of the Chesapeake Bay Program. The Chesapeake 2000 Agreement (signed by Virginia, Maryland, Pennsylvania, District of Columbia, U.S. EPA, and Chesapeake Bay Commission) newly recognizes "the need to focus on the individuality of each river, stream and creek" to meet the goal—"Preserve, protect and restore those habitats and natural areas that are vital to the survival and diversity of the living resources of the Bay and its rivers." Specifically, the Agreement commits to the following watershed-based actions:

- Develop and implement watershed management plans in two-thirds of the Bay watershed
- Develop guidelines to ensure the aquatic health of stream corridors
- Select pilot projects that promote stream corridor protection and restoration
- Make available information concerning the aquatic health of stream corridors
- Develop stream corridor restoration goals based on local watershed management planning

Results from the Round Two sampling will be used to support these actions, just as Round One results were provided to the State's Tributary Strategies program to address the nutrient reduction goals.

Maryland Land Conservation. The stream corridor information provided by the Survey will also prove invaluable for statewide programs such as the riparian buffer restoration, Rural Legacy, and GreenPrint initiatives. As part of the Chesapeake Bay wide goal of restoring 2,010 miles of riparian buffers in the Chesapeake Bay watershed by the year 2010, Maryland has committed to restoring 600 miles of riparian vegetation along its stream corridors. MBSS ground verification of remotely sensed riparian areas can be used, along with data on ecological stream condition, to determine where restoration will provide the greatest restoration benefit. In a separate initiative, Maryland has designated substantial funding to purchase GreenPrint lands that will contribute to an interconnected green infrastructure across the state. Stream corridors are an important part of the contiguous forest and wetland habitats that make up the green infrastructure (linked hubs and corridors worthy of preservation or restoration). MBSS data on the condition of constituent streams will help assign priorities for the purchase of GreenPrint lands.

Clean Water Action Plan. The results of Round Two will continue to support Maryland's participation in the federal Clean Water Action Plan. Round One MBSS data were an essential component of the first Unified Watershed Assessment prepared under this Plan; specifically, DNR incorporated mean values by Maryland 8-digit watersheds for both the fish IBI and benthic IBI. These indicators provided some of the best information provided to U.S. EPA by any state. These IBIs were used with other indicators to help designate both Category 1 (priorities for restoration) and Category 3 (priorities for protection) watersheds within Maryland. Watershed Restoration Action Strategies are being developed for five of these priority watersheds, using MBSS and other data: Georges Creek (Allegany County), Little Patuxent River (Howard County), Middle Chester River (Kent County), Manokin River (Somerset County), and Coastal Bays (Worcester County). Because the design of Round Two focuses on the finer geographic scale of Maryland 8-digit watersheds, future Unified Watershed Assessments will be more complete and Watershed Restoration Action Strategies more easily implemented.

Water Quality Standards. In addition to supporting these targeting initiatives, the identification of degraded stream segments has implications for comprehensive protection under the Clean Water Act. Section 101 of the Act states that physical, chemical, and biological integrity of waters should be maintained. Stream segments that fail to do this can be designated as degraded and not attaining designated uses as part of their water quality standards. The Maryland Department of the Environment (MDE) implements the water quality standards program and prepares a 303(d) list of streams not meeting their designated uses.

U.S. EPA continues to encourage Maryland and other states to use biological criteria (biocriteria) to meet negotiated agreements for expanding their 303(d) lists. In response, MDE developed an interim biocriteria framework that incorporates stream ratings based on fish and benthic IBIs developed by the Survey (Roth et al. 2000, Stribling et al. 1998) to identify 8-digit watersheds and 12-digit subwatersheds that are impaired. Using combined Round One and 2000 MBSS data, these impairments have been included in the biennial 305(b) water quality report and the "Draft Methodologies for Listing Pollution Impaired Waterbodies on the 2002 303(d) List." Specifically, 178 biological impairments are included in the 2002 Integrated 303(d) List based on MBSS stream ratings of poor or very poor. Ultimately, total maximum daily loads (TMDLs) must be developed for streams on this list for which an impairing substance (a pollutant) can be identified. Currently, MDE is exploring ways of using MBSS data to support development of a large number of nutrient, sediment, and other TMDLs over the next few years.

Another important use of MBSS biological data for the water quality standards program is refinement of aquatic life use designations. Each water body in Maryland has an associated designated use that (along with appropriate physical, chemical, and biological criteria) make up the water quality standard for that water body. While some streams have a special use, such as a reproducing trout stream, most have the same general aquatic life use. This general use designation does not capture the natural variability of Maryland streams and therefore does not extend any special protection to streams with unusual diversity or ecological value. U.S. EPA is encouraging states to refine their aquatic life uses into categories with more precise biocriteria. Data from the Survey will be critical to refining aquatic life use designations in this way.

Maryland Biodiversity. The information on biological diversity collected by the Survey exceeds that needed to designate the ecological condition of individual watersheds. The extensive geographic reach and quantitative sampling results of the Survey provide an unusual opportunity for evaluating the distribution and abundance of species previously designated as rare only by anecdotal evidence. For example, the endemic checkered sculpin and several other species have been collected in previously unreported locations. Based on the information gathered in Round One, Maryland DNR's Heritage and Biodiversity Programs are reevaluating state designations of rare, threatened, and endangered species. These reevaluations, as well as MBSS data on unique combinations of species at the ecosystem and landscape levels, will provide critical new information to support biodiversity conservation in the state.

Support of Local Monitoring Programs. One of the most promising trends related to the Survey has the increase in interest and activity among Maryland county governments, non-governmental organizations, private businesses, and volunteers in stream monitoring. The success of the Survey has encouraged these groups to base their water resource management more directly on monitoring results. Many have instituted their own monitoring programs, often drawing upon or adopting MBSS sampling protocols. Maryland DNR has facilitated this trend by providing training each year to whoever will attend.

Montgomery County is an example of a local government that has instituted an extensive stream monitoring program, and that is working closely with the Survey to integrate program activities, so that sampling is more cost-effective and assessment results are consistent and more precise. In addition, Maryland DNR has implemented a Stream Waders program that combines volunteer sampling effort with professional laboratory processing and quality assurance to greatly increase the number of streams that can be sampled. These efforts to support local stream monitoring will ultimately result in improve water resource management at all levels.

7.2 FUTURE DIRECTIONS

At the end of Round One, it was discovered that most of the original 64 MBSS questions that could not yet be answered dealt with identifying potential stressors using data not collected as part of the Survey. Much of this information will be gathered from other sources and linked to MBSS sites so that statewide estimates can be made of stressor extent (e.g., number of stream miles with point sources of contamination, amounts of pesticides applied by geographic area, or pattern of landscape patches in upstream catchments). The other issues of original and new interest dealt in large part with the need for finer geographic resolution. As described above, the Round Two design (including adoption of the new 1:100,000-scale stream network, focus on Maryland 8-digit watersheds, and volunteer monitoring at the 12-digit subwatershed scale) will begin to provide this improved resolution. Issues that require continued scrutiny in future years include the following:

- Extending the Survey into tidal streams
- Delineating more stream types requiring new indicators (e.g., coldwater and blackwater streams)
- Refining existing indicators (e.g., physical habitat) and developing new ones (e.g., streamside salamanders in small streams)
- Better characterization of existing and new stressors (e.g., estimating the contribution of eroded soil to sediment loading)
- Improving identification of rare species habitats and other biodiversity components
- Comparing among sample rounds for the detection of trends
- More coordination with counties for greater sample density or cost savings in areas of shared interest

Better Stream Coverage. Round Two is capturing considerably more small streams and a few more larger streams than in Round One. This increased efforts provides nearly comprehensive coverage of the stream resources in Maryland. The principal remaining gap is tidal streams, those not covered by tidewater monitoring at DNR. The Round Two design includes a component dedicated to tidal stream sampling that has not yet been implemented because of lack of funding. Specifically, the Round Two design includes pilot sampling of tidal streams that follows the lattice design used for non-tidal streams and includes the same subset of 84 watersheds for sampling each year. A random sample of 20 sites would be selected within each watershed containing tidal streams, and the number of sites allocated to each watershed would be proportional to their tidal stream length.

Development of New Stream Indicators. Analysis of Round One data revealed that Maryland contains substantial miles of streams that are ecologically distinct in terms of natural fish communities. Three kinds of streams were identified where the existing fish IBI is not an effective indicator of stream condition: (1) small streams draining catchments of less than 300 acres, (2) coldwater streams characterized by lower temperatures and prevalence of trout species, and (3) blackwater streams characterized by low pH and high organic content. In each case, separate reference conditions likely need to be used to develop appropriate indicators for these stream types. Recent analysis of MBSS data from limestone streams (characterized by high alkalinity and pH) indicated that separate reference conditions are not needed for these streams. Similar analysis of an independent U.S. EPA data set from the Mid-Atlantic Highlands came to the same conclusion.

Temperature loggers were deployed at nearly all randomly selected stream sites in 2001 (and will continue to be deployed throughout Round Two) to improve our ability to identify coldwater streams. Round Two also includes ancillary sampling of coldwater and blackwater streams (which occur in too low proportions of total streams to be captured adequately by the core survey) that will be used to support development of appropriate fish IBIs for these streams. In both 2000 and 2001, 16 ancillary coldwater sites were sampled in both stressed and healthy coldwater streams; additional sampling of blackwater streams is planned for future years. Analysis of existing coldwater and blackwater stream data has begun in hopes of developing separate reference conditions, and ultimately separate indicators, for these stream types. Two years of targeted sampling of MBSS streams for streamside salamanders have been completed in cooperation with the U.S. Geological Survey. Analysis of these data are underway and should determine whether it is feasible to use streamside salamander sampling in small MBSS streams as a second vertebrate indicator for this stream type.

In Round One, a provisional indicator of physical habitat quality, the Physical Habitat Index (PHI), was developed from the quantitative and qualitative data collected in 1995-1997. The approach focused on including only those parameters that were significantly correlated with biological characteristics of interest. In 2001, the Survey revisited its approach for assessing stream physical habitat quality by reanalyzing all existing physical habitat data and developing a new indicator. Following validation this new PHI may be incorporated into MBSS analyses.

Better Characterization of Stream Stressors. Effective characterization of stressors will continue to be an important part of the Survey. In many cases, accurate diagnosis of site-specific problems is beyond the capabilities of the Survey and follow-up monitoring is required. This will be the case in most watersheds highlighted for possible inclusion on the state's 303d list of impaired waters. Only when specific causes of degradation are identified and quantified can TMDLs be developed. Nonetheless, the Survey will continue to investigate new analyses of stressor data and produce estimates of the extent and severity of problems to help in natural resource management decision making.

In 2001, the Survey had two papers accepted that address the issue of stressor diagnosis in freshwater streams. One study analyzed MBSS data in drainage basins of mixed land uses and determined that urban land use is a strong indicator of the likelihood that IBIs will fail biocriteria thresholds. The model developed in this study can be used to screen out land use effects when searching for other stressors. In addition, the Survey developed an "expected species model" that diagnoses ecological stressors to stream fishes using species tolerances to 31 physical, chemical, and landscape variables. Like the other study, this approach found that impervious land cover was the most influential stressor on Maryland streams.

Throughout Round Two, new information is being gathered on riparian buffer, exotic plants, channelization, bar formation, and bank erosion. The total area of eroding banks was reported as an indicator of the amount of sediment being contributed downstream by each watershed. In future years, statistics on these and other stressors will be developed.

Maryland Biodiversity. As Round Two continues to sample new streams throughout the state, we expect that new location records for many species will be reported. As these records accumulate, the Survey will make them available to the Maryland DNR Heritage and Biodiversity Programs for future listing reevaluations and management planning. The Survey will also conduct more analysis on unique combinations of species at the ecosystem and landscape levels. Specifically, biodiversity maps based on Round One MBSS data and rare, threatened, and endangered species data will be augmented with Round Two data and GAP analysis data developed by the Heritage and Biodiversity Programs and U.S. Fish and Wildlife Service.

At present, little work has been done to prepare species-specific management plans for unique or at-risk aquatic species. Because the Survey collects information that can be used to identify stressors within a watershed, MBSS data can serve as a logical starting point for developing restoration and protection strategies. Given that the Survey has produced abundance estimates for rare and unique fishes, prioritization of management plan development can be based on population size and known threats.

One of the most important benefits of collecting Round Two data will be the ability of the Survey to compare results over time and detect trends in natural variability, environmental degradation, and restoration success. The sampling in Round Two provides the first opportunity to compare stream condition in selected watersheds across the two rounds. Once Round Two is completed in 2004, rigorous statewide estimates with ample sample density will be used to investigate trends. The interpretation of trends requires that natural temporal change be characterized and understood. To this end, Round Two will continue to annually monitor 25 sentinel sites selected and sampled in 2000. These sites represent the best stream conditions in the state and focus on those areas least likely to change through anthropogenic impact (e.g., in state-managed or protected areas). As Round Two progresses, data from annual sampling of sentinel sites will be analyzed for natural temporal variability.

Integration with Local Monitoring Programs. Recognizing that the core and ancillary sampling by Maryland DNR will never be able to attain the sample density needed for all management decisions in the state, the Survey is focusing on coordination with other monitoring programs (usually county governments) during Round Two. In 2000, comparability analyses were conducted with the biological sampling program of Montgomery County with funding from U.S. EPA. Differences in sample frame, survey design, sampling methods, indicator construction, and reporting were investigated and procedures for combining the results of the two programs were developed. In 2001, a experimental methods comparison study for benthic sampling was conducted that evaluated the effectiveness and comparability of differences in sampling gear, size of subsamples, and level of taxonomy. Using these and other analyses, the Survey has developed guidance data quality standards for sharing of information.

To the extent possible, sampling results (e.g., fish IBIs) will be integrated into combined estimates for public reporting throughout Round Two. The Survey will continue coordination with Montgomery, Prince George's, Howard, Carroll, Baltimore and other counties plus Baltimore City, in future years to ensure that programs obtain either greater sample densities or cost savings (from sharing sample sites) for monitoring Maryland streams. The Maryland Water Monitoring Council (MWMC) will play an active role in encouraging these collaborations between state and local agencies.

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APPENDIX A

PRECIPITATION DATA

Table A-1. Total monthly precipitation (inches) and deviation from normal for Maryland regions in 1998

Region	January-98	Deviation	February-98	Deviation	March-98	Deviation	April-98	Deviation	May-98	Deviation	June-98	Deviation	July-98	Deviation
Southern Eastern Shore	8.04	4.40	6.98	3.55	4.65	0.53	3.12	-0.05	4.46	1.00	5.15	1.76	1.52	-2.53
Central Eastern Shore	7.41	3.83	6.34	3.08	5.33	1.59	3.19	0.44	3.39	-0.56	5.10	1.45	1.40	-2.54
Lower Southern	6.69	3.41	7.00	3.96	6.35	2.66	3.51	0.32	4.29	0.21	6.95	3.23	1.02	-2.94
Upper Southern	5.77	2.72	5.94	3.00	6.37	2.96	3.75	0.43	4.74	0.52	4.01	0.31	1.69	-2.32
Northern Eastern Shore	5.65	2.38	4.30	0.98	6.03	2.48	3.65	0.37	4.92	0.91	4.92	0.93	3.42	-0.38
Northern Central	6.00	2.92	4.93	1.96	6.34	2.81	3.94	0.41	5.51	1.14	4.67	0.69	3.17	-0.63
Appalachian Mountain	4.50	1.89	5.29	2.74	3.32	0.01	4.76	1.32	3.91	-0.02	4.44	0.99	2.76	-0.78
Allegany Plateau	4.74	1.56	4.38	1.43	3.44	-0.52	5.54	1.47	5.01	0.64	6.54	2.46	3.29	-1.57
Average for State	6.10	2.89	5.65	2.59	5.23	1.57	3.93	0.59	4.53	0.48	5.22	1.48	2.28	-1.71

Table A-1. (Continued)

Region	August-98	Deviation	September-98	Deviation	October-98	Deviation	November-98	Deviation	December-98	Deviation	Annual	Deviation
Southern Eastern Shore	2.75	-2.12	1.53	-1.88	1.01	-2.17	1.10	-2.02	3.67	0.26	43.98	0.73
Central Eastern Shore	3.02	-1.38	1.34	-2.17	2.58	-0.49	1.02	-2.30	4.20	0.64	44.92	1.59
Lower Southern	1.55	-2.42	0.50	-3.17	1.28	-1.96	1.17	-2.22	2.50	-0.83	42.81	0.25
Upper Southern	1.31	-2.86	1.79	-1.79	0.92	-2.39	1.27	-2.16	1.79	-1.58	39.32	-3.16
Northern Eastern Shore	3.03	-0.85	2.86	-0.79	1.36	-1.78	0.90	-2.49	1.87	-1.82	42.63	-0.06
Northern Central	2.57	-1.28	1.82	-1.89	2.82	-0.52	1.10	-2.48	1.19	-2.28	44.06	0.85
Appalachian Mountain	2.29	-1.05	1.74	-1.46	1.33	-1.84	0.25	-2.86	0.85	-1.97	35.44	-3.03
Allegany Plateau	3.74	-0.09	3.26	-0.06	1.49	-1.68	0.48	-3.08	1.30	-2.38	43.21	-1.82
Average for State	2.53	-1.51	1.86	-1.65	1.60	-1.60	0.91	-2.45	2.17	-1.25	42.05	-0.58

Table A-1. Total monthly precipitation (inches) and deviation from normal for Maryland regions in 1999 (NOAA 1999)

Region	Jan-99	Deviation	Feb-99	Deviation	Mar-99	Deviation	Apr-99	Deviation	May-99	Deviation	Jun-99	Deviation	Jul-99	Deiviation
Southern Eastern Shore	4.98	1.34	2.90	-0.53	4.65	0.53	3.12	-0.05	4.46	1.00	5.15	1.76	3.80	-0.25
Central Eastern Shore	5.68	2.10	2.58	-0.68	5.33	1.59	3.19	0.44	3.39	-0.56	5.10	1.45	4.93	0.99
Lower Southern	5.20	1.92	2.20	-0.84	6.35	2.66	3.51	0.32	4.29	0.21	6.95	3.23	2.21	-1.75
Upper Southern	5.43	2.38	2.34	-0.60	6.37	2.96	3.75	0.43	4.74	0.52	4.01	0.31	1.72	-2.29
Northern Eastern Shore	4.84	1.57	3.17	0.13	6.03	2.48	3.65	0.37	4.92	0.91	4.92	0.93	3.61	-0.19
Northern Central	6.02	2.94	3.04	0.07	6.34	2.81	3.94	0.41	5.51	1.14	4.67	0.69	1.60	-2.20
Appalachian Mountain	4.30	1.69	1.50	-1.05	3.32	0.01	4.76	1.32	3.91	-0.02	4.44	0.99	1.79	-1.75
Allegany Plateau	4.97	1.79	2.30	-0.65	3.44	-0.52	5.54	1.47	5.01	0.64	6.54	2.46	3.04	-1.82
Average for State	5.18	1.97	2.50	-0.52	5.23	1.57	3.93	0.59	4.53	0.48	5.22	1.48	2.84	-1.16

Table A-1. (Continued)

Region	Aug-99	Deviation	Sep-99	Deviation	Oct-99	Deviation	Nov-99	Deviation	Dec-99	Deviation	Annual	Deviation
Southern Eastern Shore	4.57	-0.30	9.19	5.78	4.70	1.52	1.70	-1.42	2.39	-1.02	45.80	2.55
Central Eastern Shore	4.55	0.15	12.86	9.35	3.36	0.29	1.93	-1.39	2.59	-0.97	48.11	4.78
Lower Southern	6.61	2.64	11.75	8.08	3.50	0.26	1.45	-1.94	2.25	-1.08	46.02	3.46
Upper Southern	5.68	1.51	12.21	8.63	2.66	-0.65	2.18	-1.22	3.08	-0.29	46.55	4.07
Northern Eastern Shore	4.43	0.55	16.13	12.48	3.19	0.05	2.30	-1.09	2.42	-1.27	50.84	8.15
Northern Central	4.51	0.663	10.78	7.07	2.88	-0.46	2.01	-1.57	3.10	-0.37	44.99	1.78
Appalachian Mountain	2.27	- 1.07	5.45	2.25	2.26	-0.91	1.72	-1.39	2.07	-0.75	34.34	-4.13
Allegany Plateau	2.08	-1.75	3.46	0.14	2.85	-0.32	3.31	-0.25	1.98	-1.70	37.61	-7.42
Average for State	4.34	0.30	10.23	6.72	3.18	-0.03	2.08	-1.28	2.49	-0.93	44.28	1.66

Table A-3. Total monthly precipitation (inches) and deviation from normal for Maryland regions in 2000 (NOAA 2000)

Region	January-01	Deviation	February-01	Deviation	March-01	Deviation	April-01	Deviation	May-01	Deviation	June-01	Deviation	July-01	Deviation
Southern Eastern Shore	2.53	-1.11	2.66	-0.77	6.19	2.07	2.66	-5.10	3.72	0.26	3.93	0.54	4.84	0.79
Central Eastern Shore	3.51	-0.07	2.67	-0.59	5.57	1.83	1.54	-1.81	5.17	1.22	5.72	2.07	5.08	1.14
Lower Southern	NA	NA	2.30	-0.74	5.00	1.31	1.61	-1.58	6.73	2.65	5.27	1.55	7.73	3.77
Upper Southern	2.75	-0.30	2.22	-0.72	4.81	1.40	1.82	-1.50	5.01	0.79	5.17	1.47	5.25	1.24
Northern Eastern Shore	3.26	-0.01	3.26	0.22	5.78	2.23	1.97	-1.31	5.78	1.77	3.34	-0.65	6.22	2.42
Northern Central	3.98	0.90	1.94	-1.03	4.67	1.14	2.31	-1.22	3.76	-0.61	4.47	0.49	2.05	-1.75
Appalachian Mountain	1.94	-0.67	1.00	-1.55	4.00	0.69	2.30	-1.14	5.00	1.07	4.52	1.07	3.38	-0.16
Allegany Plateau	2.85	-0.33	1.76	-1.19	4.15	0.19	2.72	-1.35	4.70	0.33	6.30	2.22	6.83	1.97
Average for State	2.97	-0.23	2.23	-0.80	5.02	1.36	2.12	-1.88	4.98	0.94	4.84	1.10	5.17	1.18

Table A-3. (Continued)

Region	August-01	Deviation	September-01	Deviation	October-01	Deviation	November-01	Deviation	December-01	Deviation	Annual	Deviation
Southern Eastern Shore	6.11	1.24	1.74	-1.67	1.08	-2.10	0.06	-3.06	2.22	-1.19	37.74	-5.51
Central Eastern Shore	6.47	2.07	1.87	-1.64	1.01	-2.06	0.40	-2.92	1.97	-1.59	40.98	-2.35
Lower Southern	NA	NA	2.54	-1.13	0.88	-2.36	0.97	-2.42	1.98	-1.35	NA	NA
Upper Southern	4.87	0.70	2.48	-1.10	0.85	-2.46	1.28	-2.12	1.58	-1.79	38.09	-4.39
Northern Eastern Shore	NA	NA	3.18	-0.47	0.80	-2.34	1.36	-2.03	1.51	-2.18	NA	NA
Northern Central	3.11	-0.74	3.93	0.22	0.97	-2.37	1.70	-1.88	1.79	-1.68	34.68	-8.53
Appalachian Mountain	3.07	-0.27	2.06	-1.14	0.69	-2.48	1.40	-1.71	1.83	-0.99	31.19	-7.28
Allegany Plateau	2.84	-0.99	1.83	-1.49	131.00	-1.86	1.08	-2.48	3.12	-0.56	39.49	-5.54
Average for State	4.41	0.34	2.45	-1.05	17.16	-2.25	1.03	-2.33	2.00	-1.42	37.03	-5.60

Table A-4. Total monthly precipitation (inches) and deviation from normal for Maryland regions in 2001 (NOAA 2001)														
Region	**January-01**	**Deviation**	**February-01**	**Deviation**	**March-01**	**Deviation**	**April-01**	**Deviation**	**May-01**	**Devation**	**June-01**	**Deviation**	**July-01**	**Devation**
Southern Eastern Shore	2.53	-1.11	2.66	-0.77	6.19	2.07	2.66	-5.10	3.72	0.26	3.93	0.54	4.84	0.79
Central Eastern Shore	3.51	-0.07	2.67	-0.59	5.57	1.83	1.54	-1.81	5.17	1.22	5.72	2.07	5.08	1.14
Lower Southern	NA	NA	2.30	-0.74	5.00	1.31	1.61	-1.58	6.73	2.65	5.27	1.55	7.73	3.77
Upper Southern	2.75	-0.30	2.22	-0.72	4.81	1.40	1.82	-1.50	5.01	0.79	5.17	1.47	5.25	1.24
Northern Eastern Shore	3.26	-0.01	3.26	0.22	5.78	2.23	1.97	-1.31	5.78	1.77	3.34	-0.65	6.22	2.42
Northern Central	3.98	0.90	1.94	-1.03	4.67	1.14	2.31	-1.22	3.76	-0.61	4.47	0.49	2.05	-1.75
Appalachian Mountain	1.94	-0.67	1.00	-1.55	4.00	0.69	2.30	-1.14	5.00	1.07	4.52	1.07	3.38	-0.16
Allegany Plateau	2.85	-0.33	1.76	-1.19	4.15	0.19	2.72	-1.35	4.70	0.33	6.30	2.22	6.83	1.97
Average for State	2.97	-0.23	2.23	-0.80	5.02	1.36	2.12	-1.88	4.98	0.94	4.84	1.10	5.17	1.18

Table A-4. (Continued)												
Region	**August-01**	**Devation**	**September-01**	**Devation**	**October-01**	**Deviation**	**November-01**	**Deviation**	**December-01**	**Deviation**	**Annual**	**Deviation**
Southern Eastern Shore	6.11	1.24	1.74	-1.67	1.08	-2.10	0.06	-3.06	2.22	-1.19	37.74	-5.51
Central Eastern Shore	6.47	2.07	1.87	-1.64	1.01	-2.06	0.40	-2.92	1.97	-1.59	40.98	-2.35
Lower Southern	NA	NA	2.54	-1.13	0.88	-2.36	0.97	-2.42	1.98	-1.35	NA	NA
Upper Southern	4.87	0.70	2.48	-1.10	0.85	-2.46	1.28	-2.12	1.58	-1.79	38.09	-4.39
Northern Eastern Shore	NA	NA	3.18	-0.47	0.80	-2.34	1.36	-2.03	1.51	-2.18	NA	NA
Northern Central	3.11	-0.74	3.93	0.22	0.97	-2.37	1.70	-1.88	1.79	-1.68	34.68	-8.53
Appalachian Mountain	3.07	-0.27	2.06	-1.14	0.69	-2.48	1.40	-1.71	1.83	-0.99	31.19	-7.28
Allegany Plateau	2.84	-0.99	1.83	-1.49	131.00	-1.86	1.08	-2.48	3.12	-0.56	39.49	-5.54
Average for State	4.41	0.34	2.45	-1.05	17.16	-2.25	1.03	-2.33	2.00	-1.42	37.03	-5.60

APPENDIX B

PARAMETER ESTIMATES BY PSU

Table B-1. Fish IBI					
PSU	**Mean**	**Median**	**Standard Dev.**	**Minimum**	**Maximum**
Deer Creek	3.75	3.89	0.78	1.89	4.78
Upper Pocomoke River	3.02	3.00	0.87	1.50	4.50
Dividing Creek/Nassawango Creek	3.46	3.25	0.68	2.50	4.75
Nanticoke River	2.63	3.13	1.10	1.00	3.75
Northeast River/Furnace Bay	3.78	3.78	0.50	3.22	4.56
Sasssafras River/Stillpond-Fairlee	3.32	3.50	1.00	1.25	4.25
Little Gunpowder Falls	3.86	4.33	0.94	2.11	4.78
Bodkin Creek/Baltimore Harbor	2.43	2.00	1.13	1.00	3.75
Patuxent River Middle	2.58	2.50	1.06	1.00	4.75
Western Branch	3.78	4.00	0.98	2.25	4.75
Assawoman/Isle of Wight/Sinepuxent/Newport/ Chincoteague Bays	2.81	2.88	0.43	2.25	3.25
Gilbert Swamp	3.00	2.88	1.29	1.00	5.00
Zekiah Swamp	3.73	3.75	0.62	2.75	4.75
Potomac Upper Tidal/Oxon Creek	2.04	1.75	1.28	1.00	4.50
Piscataway Creek	3.17	3.25	0.65	2.00	4.25
Seneca Creek	3.33	3.89	1.04	1.44	4.11
Potomac AL Co/Sideling Hill Creek	2.94	3.86	1.66	1.00	4.43
Potomac River Upper North Branch	1.90	1.43	1.13	1.00	3.57
Youghiogheny River	2.96	3.29	1.25	1.00	4.43

Table B-2. Fish IBI			
PSU	**Percentage of Stream Miles with FIBI < 3**	**Lower 90% CI**	**Upper 90% CI**
Deer Creek	9.09	0.47	36.44
Upper Pocomoke River	36.36	13.51	65.02
Dividing Creek/Nassawango Creek	14.29	0.73	52.07
Nanticoke River	33.33	6.28	72.87
Northeast River/Furnace Bay	0.00	0.00	31.23
Sasssafras River/Stillpond-Fairlee	14.29	0.73	52.07
Little Gunpowder Falls	14.29	0.73	52.07
Bodkin Creek/Baltimore Harbor	57.14	22.53	87.12
Patuxent River Middle	66.67	39.09	87.71
Western Branch	25.00	4.64	59.97
Assawoman/Isle of Wight/Sinepuxent/ Newport/Chincoteague Bays	50.00	9.76	90.24
Gilbert Swamp	50.00	15.32	84.68
Zekiah Swamp	10.00	0.51	39.42
Potomac Upper Tidal/Oxon Creek	85.71	47.93	99.27
Piscataway Creek	22.22	4.10	54.96
Seneca Creek	25.00	4.64	59.97
Potomac AL Co/Sideling Hill Creek	40.00	7.64	81.07
Potomac River Upper North Branch	66.67	27.13	93.72
Youghiogheny River	30.77	11.27	57.26

Table B-3. Benthic IBI					
PSU	**Mean**	**Median**	**Standard Dev.**	**Minimum**	**Maximum**
Deer Creek	4.17	4.22	0.54	2.78	4.78
Upper Pocomoke River	2.32	2.43	0.67	1.29	3.57
Dividing Creek/Nassawango Creek	2.66	2.71	1.13	1.29	4.14
Nanticoke River	2.74	2.86	0.93	1.57	4.14
Northeast River/Furnace Bay	3.80	3.89	0.66	2.14	4.33
Sasssafras River/Stillpond-Fairlee	2.46	2.43	0.54	1.86	3.57
Little Gunpowder Falls	3.76	4.22	0.97	1.67	4.56
Bodkin Creek/Baltimore Harbor	1.94	1.71	0.88	1.00	3.57
Patuxent River Middle	2.76	2.71	0.75	1.29	4.14
Western Branch	2.43	2.57	0.43	1.86	3.00
Assawoman/Isle of Wight/ Sinepuxent/ Newport/Chincoteague Bays	1.89	1.57	0.66	1.00	2.71
Gilbert Swamp	3.09	3.00	0.92	1.86	4.71
Zekiah Swamp	3.42	3.57	0.82	1.29	4.71
Potomac Upper Tidal/Oxon Creek	1.91	1.57	0.71	1.00	3.00
Piscataway Creek	2.29	2.43	0.43	1.57	2.71
Seneca Creek	2.82	3.00	0.84	1.44	4.11
Potomac AL Co/Sideling Hill Creek	3.44	3.44	0.54	2.56	4.33
Potomac River Upper North Branch	3.27	3.33	0.87	2.11	4.56
Youghiogheny River	3.58	3.89	1.06	1.44	4.78

Table B-4. Benthic IBI			
PSU	**Percentage of Stream Miles with BIBI < 3**	**Lower 90% CI**	**Upper 90% CI**
Deer Creek	9.09	0.47	36.44
Upper Pocomoke River	81.82	52.99	96.67
Dividing Creek/Nassawango Creek	28.57	5.34	65.87
Nanticoke River	33.33	6.28	72.87
Northeast River/Furnace Bay	0.00	0.00	31.23
Sasssafras River/Stillpond-Fairlee	71.43	34.13	94.66
Little Gunpowder Falls	14.29	0.73	52.07
Bodkin Creek/Baltimore Harbor	71.43	34.13	94.66
Patuxent River Middle	50.00	24.53	75.47
Western Branch	87.50	52.93	99.36
Assawoman/Isle of Wight/Sinepuxent/ Newport/Chincoteague Bays	100.00	47.29	100.00
Gilbert Swamp	33.33	6.28	72.87
Zekiah Swamp	0.00	0.00	25.89
Potomac Upper Tidal/Oxon Creek	100.00	65.18	100.00
Piscataway Creek	100.00	71.69	100.00
Seneca Creek	50.00	19.29	80.71
Potomac AL Co/Sideling Hill Creek	0.00	0.00	45.07
Potomac River Upper North Branch	66.67	27.13	93.72
Youghiogheny River	30.77	11.27	57.26

Table B-5. Combined Biotic Index					
PSU	**Mean**	**Median**	**Standard Dev.**	**Minimum**	**Maximum**
Deer Creek	3.98	4.06	0.44	3.22	4.56
Upper Pocomoke River	2.59	2.71	0.71	1.29	3.89
Dividing Creek/Nassawango Creek	2.81	2.91	1.00	1.29	4.16
Nanticoke River	2.63	2.86	0.90	1.43	3.80
Northeast River/Furnace Bay	3.71	3.89	0.64	2.14	4.44
Sasssafras River/Stillpond-Fairlee	2.79	2.82	0.61	1.55	3.63
Little Gunpowder Falls	3.70	4.17	1.00	1.67	4.56
Bodkin Creek/Baltimore Harbor	2.01	1.75	0.90	1.00	3.38
Patuxent River Middle	2.66	2.61	0.75	1.39	4.07
Western Branch	3.00	2.78	0.63	2.05	3.75
Assawoman/Isle of Wight/Sinepuxent/ Newport/Chincoteague Bays	1.96	1.57	0.69	1.00	2.86
Gilbert Swamp	2.96	3.08	0.82	1.43	3.86
Zekiah Swamp	3.41	3.43	0.83	1.29	4.48
Potomac Upper Tidal/Oxon Creek	2.05	2.04	0.77	1.00	3.04
Piscataway Creek	2.68	2.78	0.44	2.04	3.34
Seneca Creek	2.98	3.22	0.88	1.44	4.11
Potomac AL Co/Sideling Hill Creek	3.23	3.22	0.67	2.37	4.27
Potomac River Upper North Branch	2.98	3.33	1.10	1.56	4.56
Youghiogheny River	3.29	3.79	1.05	1.37	4.60

Table B-6. Combined Biotic Index IBI			
PSU	**Percentage of Stream Miles with CBI < 3**	**Lower 90% CI**	**Upper 90% CI**
Deer Creek	0.00	0.00	23.84
Upper Pocomoke River	63.64	34.98	86.49
Dividing Creek/Nassawango Creek	28.57	5.34	65.87
Nanticoke River	33.33	6.28	72.87
Northeast River/Furnace Bay	0.00	0.00	31.23
Sasssafras River/Stillpond-Fairlee	57.14	22.53	87.12
Little Gunpowder Falls	14.29	0.73	52.07
Bodkin Creek/Baltimore Harbor	71.43	34.13	94.66
Patuxent River Middle	75.00	47.27	92.81
Western Branch	50.00	19.29	80.71
Assawoman/Isle of Wight/Sinepuxent/ Newport/Chincoteague Bays	100.00	47.29	100.00
Gilbert Swamp	16.67	0.85	58.18
Zekiah Swamp	0.00	0.00	25.89
Potomac Upper Tidal/Oxon Creek	85.71	47.93	99.27
Piscataway Creek	77.78	45.04	95.90
Seneca Creek	25.00	4.64	59.97
Potomac AL Co/Sideling Hill Creek	40.00	7.64	81.07
Potomac River Upper North Branch	66.67	27.13	93.72
Youghiogheny River	30.77	11.27	57.26

Table B-7. Spring pH < 6			
PSU	**Percentage of Stream Miles with Spring pH < 6**	**Lower 90% CI**	**Upper 90% CI**
Deer Creek	0.00	0.00	19.26
Upper Pocomoke River	15.38	2.81	41.01
Dividing Creek/Nassawango Creek	50.00	22.24	77.76
Nanticoke River	30.00	8.73	60.66
Northeast River/Furnace Bay	10.00	0.51	39.42
Sasssafras River/Stillpond-Fairlee	11.11	0.57	42.91
Little Gunpowder Falls	0.00	0.00	25.89
Bodkin Creek/Baltimore Harbor	10.00	0.51	39.42
Patuxent River Middle	7.69	0.39	31.63
Western Branch	0.00	0.00	25.89
Assawoman/Isle of Wight/Sinepuxent/ Newport/Chincoteague Bays	22.22	4.10	54.96
Gilbert Swamp	10.00	0.51	39.42
Zekiah Swamp	23.08	6.60	49.46
Potomac Upper Tidal/Oxon Creek	10.00	0.51	39.42
Piscataway Creek	10.00	0.51	39.42
Seneca Creek	0.00	0.00	18.10
Potomac AL Co/Sideling Hill Creek	0.00	0.00	25.89
Potomac River Upper North Branch	30.00	8.73	60.66
Youghiogheny River	18.75	5.31	41.66

Table B-8. Summer pH < 6			
PSU	**Percentage of Stream Miles with Summer pH < 6**	**Lower 90% CI**	**Upper 90% CI**
Deer Creek	0	0	19.76
Upper Pocomoke River	8.33	4.3	33.87
Dividing Creek/Nassawango Creek	50	22.24	76
Nanticoke River	33.33	9.77	65.51
Northeast River/Furnace Bay	10	0.51	39.42
Sasssafras River/Stillpond-Fairlee	0	0	28.31
Little Gunpowder Falls	0	0	25.89
Bodkin Creek/Baltimore Harbor	0	0	25.89
Patuxent River Middle	23.08	6.6	49.46
Western Branch	0	0	28.31
Assawoman/Isle of Wight/Sinepuxent/ Newport/Chincoteague Bays	0	0	65.18
Gilbert Swamp	10	5.1	39.42
Zekiah Swamp	23.08	6.6	49.46
Potomac Upper Tidal/Oxon Creek	0	0	25.89
Piscataway Creek	10	5.1	39.42
Seneca Creek	0	0	19.76
Potomac AL Co/Sideling Hill Creek	0	0	39.3
Potomac River Upper North Branch	10	5.1	39.42
Youghiogheny River	18.75	5.31	41.66

Table B-9. ANC < 50 µeq/l			
PSU	**Percentage of Stream Miles with ANC < 50 µeq/l**	**Lower 90% CI**	**Upper 90% CI**
Deer Creek	0.00	0.00	19.26
Upper Pocomoke River	15.38	2.81	41.01
Dividing Creek/Nassawango Creek	40.00	15.00	69.65
Nanticoke River	20.00	3.68	50.69
Northeast River/Furnace Bay	10.00	0.51	39.42
Sasssafras River/Stillpond-Fairlee	0.00	0.00	28.31
Little Gunpowder Falls	0.00	0.00	25.89
Bodkin Creek/Baltimore Harbor	0.00	0.00	25.89
Patuxent River Middle	7.69	0.39	31.63
Western Branch	0.00	0.00	25.89
Assawoman/Isle of Wight/Sinepuxent/ Newport/Chincoteague Bays	11.11	0.57	42.91
Gilbert Swamp	10.00	0.51	39.42
Zekiah Swamp	30.77	11.27	57.26
Potomac Upper Tidal/Oxon Creek	10.00	0.51	39.42
Piscataway Creek	0.00	0.00	25.59
Seneca Creek	0.00	0.00	18.10
Potomac AL Co/Sideling Hill Creek	0.00	0.00	25.59
Potomac River Upper North Branch	50.00	22.24	77.76
Youghiogheny River	18.75	5.31	41.66

Table B-10. ANC < 200 µeq/l			
PSU	**Percentage of Stream Miles with ANC < 200 µeq/l**	**Lower 90% CI**	**Upper 90% CI**
Deer Creek	21.43	6.11	46.57
Upper Pocomoke River	46.15	22.40	71.30
Dividing Creek/Nassawango Creek	90.00	60.58	99.49
Nanticoke River	50.00	22.24	77.78
Northeast River/Furnace Bay	20.00	3.68	50.69
Sasssafras River/Stillpond-Fairlee	33.33	9.77	65.51
Little Gunpowder Falls	0.00	0.00	25.89
Bodkin Creek/Baltimore Harbor	10.00	0.51	39.42
Patuxent River Middle	76.92	50.54	93.40
Western Branch	20.00	3.68	50.69
Assawoman/Isle of Wight/Sinepuxent/ Newport/Chincoteague Bays	22.22	4.10	45.02
Gilbert Swamp	90.00	60.58	99.49
Zekiah Swamp	100.00	79.42	100.00
Potomac Upper Tidal/Oxon Creek	20.00	3.68	50.69
Piscataway Creek	30.00	8.73	60.66
Seneca Creek	13.33	2.42	36.34
Potomac AL Co/Sideling Hill Creek	70.00	39.34	91.27
Potomac River Upper North Branch	70.00	39.34	91.37
Youghiogheny River	87.50	65.52	97.73

Table B-11. Physical Habitat Indicator					
PSU	**Mean**	**Median**	**Standard Dev.**	**Minimum**	**Maximum**
Deer Creek	60.37	63.79	30.93	5.25	98.98
Upper Pocomoke River	46.22	40.13	29.68	4.41	93.67
Dividing Creek/Nassawango Creek	61.57	75.60	23.05	23.87	86.11
Nanticoke River	61.71	72.86	32.96	6.10	95.88
Northeast River/Furnace Bay	61.00	55.95	31.94	8.31	99.74
Sasssafras River/Stillpond-Fairlee	57.88	69.48	30.43	9.92	92.62
Little Gunpowder Falls	49.21	46.31	32.81	3.22	91.90
Bodkin Creek/Baltimore Harbor	41.69	44.30	33.32	1.14	85.44
Patuxent River Middle	55.61	50.19	23.51	29.00	94.17
Western Branch	68.16	75.19	20.74	26.36	89.72
Assawoman/Isle of Wight/Sinepuxent/ Newport/Chincoteague Bays	47.24	39.87	20.72	24.07	83.87
Gilbert Swamp	61.57	64.00	24.72	6.29	89.92
Zekiah Swamp	68.14	81.00	29.90	5.11	94.80
Potomac Upper Tidal/Oxon Creek	47.89	58.72	31.73	1.10	88.98
Piscataway Creek	57.69	60.22	27.58	6.55	92.62
Seneca Creek	52.87	53.41	27.67	5.25	92.05
Potomac AL Co/Sideling Hill Creek	44.03	32.13	30.96	17.05	83.35
Potomac River Upper North Branch	92.10	94.00	7.17	75.01	99.98
Youghiogheny River	74.02	84.84	25.18	20.14	97.53

Table B-12. PHI < 42			
PSU	**Percentage of Stream Miles with PHI < 42**	**Lower 90% CI**	**Upper 90% CI**
Deer Creek	18.18	3.33	47.01
Upper Pocomoke River	45.45	19.96	72.88
Dividing Creek/Nassawango Creek	14.29	0.73	52.07
Nanticoke River	16.67	0.85	58.18
Northeast River/Furnace Bay	25.00	4.64	59.97
Sasssafras River/Stillpond-Fairlee	14.29	0.73	52.07
Little Gunpowder Falls	28.57	5.34	65.87
Bodkin Creek/Baltimore Harbor	28.57	5.34	65.87
Patuxent River Middle	33.33	12.29	60.91
Western Branch	12.50	0.64	47.07
Assawoman/Isle of Wight/Sinepuxent/ Newport/Chincoteague Bays	50.00	9.76	90.24
Gilbert Swamp	16.67	0.85	58.18
Zekiah Swamp	10.00	0.51	39.42
Potomac Upper Tidal/Oxon Creek	28.57	5.34	65.87
Piscataway Creek	22.22	4.10	54.96
Seneca Creek	12.50	0.64	47.07
Potomac AL Co/Sideling Hill Creek	60.00	18.93	92.36
Potomac River Upper North Branch	0.00	0.00	39.30
Youghiogheny River	7.69	0.39	31.63

Table B-13. Channelized			
PSU	**Percentage of Stream Miles Channelized**	**Lower 90% CI**	**Upper 90% CI**
Deer Creek	7.14	0.37	29.67
Upper Pocomoke River	76.92	50.54	93.40
Dividing Creek/Nassawango Creek	60.00	30.35	85.00
Nanticoke River	20.00	3.68	50.69
Northeast River/Furnace Bay	0.00	0.00	25.89
Sasssafras River/Stillpond-Fairlee	11.11	0.57	42.91
Little Gunpowder Falls	10.00	0.51	39.42
Bodkin Creek/Baltimore Harbor	50.00	22.24	77.76
Patuxent River Middle	7.69	0.39	31.63
Western Branch	40.00	15.00	69.65
Assawoman/Isle of Wight/Sinepuxent/ Newport/Chincoteague Bays	66.67	34.49	90.23
Gilbert Swamp	30.00	8.73	60.66
Zekiah Swamp	0.00	0.00	25.89
Potomac Upper Tidal/Oxon Creek	60.00	30.35	85.00
Piscataway Creek	0.00	0.00	25.89
Seneca Creek	26.67	9.67	51.08
Potomac AL Co/Sideling Hill Creek	0.00	0.00	25.89
Potomac River Upper North Branch	10.00	0.51	39.42
Youghiogheny River	0.00	0.00	17.07

Table B-14. Moderate to Severe Erosion			
PSU	**Percentage of Stream Miles with Moderate to Severe Erosion**	**Lower 90% CI**	**Upper 90% CI**
Deer Creek	64.29	39.04	84.73
Upper Pocomoke River	16.67	3.05	43.81
Dividing Creek/Nassawango Creek	0.00	0.00	34.82
Nanticoke River	11.11	0.57	42.91
Northeast River/Furnace Bay	77.78	45.04	95.90
Sasssafras River/Stillpond-Fairlee	22.22	4.10	54.96
Little Gunpowder Falls	70.00	39.34	91.27
Bodkin Creek/Baltimore Harbor	40.00	15.00	69.65
Patuxent River Middle	84.62	58.99	97.19
Western Branch	66.67	34.49	90.23
Assawoman/Isle of Wight/Sinepuxent/ Newport/Chincoteague Bays	28.57	5.34	65.87
Gilbert Swamp	40.00	15.00	69.65
Zekiah Swamp	38.46	16.57	64.52
Potomac Upper Tidal/Oxon Creek	60.00	30.35	85.00
Piscataway Creek	100.00	74.11	100.00
Seneca Creek	64.29	39.04	84.73
Potomac AL Co/Sideling Hill Creek	33.33	6.28	72.87
Potomac River Upper North Branch	20.00	3.68	50.69
Youghiogheny River	25.00	9.03	48.44

Table B-15. Moderate to Extensive Bar Formation			
PSU	**Percentage of Stream Miles with Moderate to Extensive Bar Formation**	**Lower 90% CI**	**Upper 90% CI**
Deer Creek	28.57	10.40	54.00
Upper Pocomoke River	41.67	18.10	68.48
Dividing Creek/Nassawango Creek	0.00	0.00	34.82
Nanticoke River	11.11	0.57	42.91
Northeast River/Furnace Bay	44.44	16.88	74.86
Sasssafras River/Stillpond-Fairlee	33.33	9.77	65.51
Little Gunpowder Falls	20.00	3.68	50.69
Bodkin Creek/Baltimore Harbor	10.00	0.51	39.42
Patuxent River Middle	84.62	58.99	97.19
Western Branch	66.67	34.49	90.23
Assawoman/Isle of Wight/Sinepuxent/ Newport/Chincoteague Bays	42.86	12.88	77.47
Gilbert Swamp	40.00	15.00	69.65
Zekiah Swamp	30.77	11.27	57.26
Potomac Upper Tidal/Oxon Creek	70.00	39.34	91.27
Piscataway Creek	100.00	74.11	100.00
Seneca Creek	42.86	20.61	67.50
Potomac AL Co/Sideling Hill Creek	16.67	0.85	58.18
Potomac River Upper North Branch	30.00	8.73	60.66
Youghiogheny River	37.50	17.78	60.90

Table B-16. No Riparian Buffer on at Least One Bank			
PSU	**Percentage of Stream Miles with 0m Riparian Buffer on at Least One Bank**	**Lower 90% CI**	**Upper 90% CI**
Deer Creek	7.14	0.37	29.67
Upper Pocomoke River	46.15	22.40	71.30
Dividing Creek/Nassawango Creek	0.00	0.00	25.89
Nanticoke River	10.00	5.10	39.42
Northeast River/Furnace Bay	0.00	0.00	25.89
Sasssafras River/Stillpond-Fairlee	0.00	0.00	28.31
Little Gunpowder Falls	20.00	3.68	50.69
Bodkin Creek/Baltimore Harbor	20.00	3.68	50.69
Patuxent River Middle	0.00	0.00	20.58
Western Branch	0.00	0.00	25.89
Assawoman/Isle of Wight/Sinepuxent/ Newport/Chincoteague Bays	11.11	0.57	42.91
Gilbert Swamp	0.00	0.00	25.89
Zekiah Swamp	0.00	0.00	20.58
Potomac Upper Tidal/Oxon Creek	0.00	0.00	25.89
Piscataway Creek	0.00	0.00	25.89
Seneca Creek	26.67	9.67	51.08
Potomac AL Co/Sideling Hill Creek	0.00	0.00	25.89
Potomac River Upper North Branch	10.00	0.51	39.42
Youghiogheny River	18.75	5.31	41.66

Table B-17. No Riparian Buffer on at Both Banks			
PSU	**Percentage of Stream Miles with 0 m Riparian Buffer on at Both Banks**	**Lower 90% CI**	**Upper 90% CI**
Deer Creek	7.14	0.37	29.67
Upper Pocomoke River	30.77	11.27	57.26
Dividing Creek/Nassawango Creek	0.00	0.00	25.89
Nanticoke River	0.00	0.00	25.89
Northeast River/Furnace Bay	0.00	0.00	25.89
Sasssafras River/Stillpond-Fairlee	0.00	0.00	28.31
Little Gunpowder Falls	20.00	3.68	50.69
Bodkin Creek/Baltimore Harbor	10.00	0.51	39.42
Patuxent River Middle	0.00	0.00	20.58
Western Branch	0.00	0.00	25.89
Assawoman/Isle of Wight/Sinepuxent/ Newport/Chincoteague Bays	11.11	0.57	42.91
Gilbert Swamp	0.00	0.00	25.89
Zekiah Swamp	0.00	0.00	20.58
Potomac Upper Tidal/Oxon Creek	0.00	0.00	25.89
Piscataway Creek	0.00	0.00	25.89
Seneca Creek	20.00	5.68	43.98
Potomac AL Co/Sideling Hill Creek	0.00	0.00	25.89
Potomac River Upper North Branch	10.00	0.51	39.42
Youghiogheny River	6.25	0.32	26.40

Table B-18. Exotic Plants Observed			
PSU	**Percentage of Stream Miles with Exotic Plants Observed**	**Lower 90% CI**	**Upper 90% CI**
Deer Creek	100.00	80.74	100.00
Upper Pocomoke River	66.67	39.09	97.71
Dividing Creek/Nassawango Creek	28.57	5.34	65.87
Nanticoke River	66.67	34.49	90.23
Northeast River/Furnace Bay	100.00	71.69	100.00
Sasssafras River/Stillpond-Fairlee	100.00	71.69	100.00
Little Gunpowder Falls	100.00	74.11	100.00
Bodkin Creek/Baltimore Harbor	100.00	74.11	100.00
Patuxent River Middle	92.31	68.37	99.61
Western Branch	100.00	71.69	100.00
Assawoman/Isle of Wight/Sinepuxent/ Newport/Chincoteague Bays	100.00	65.18	100.00
Gilbert Swamp	80.00	49.31	96.32
Zekiah Swamp	100.00	79.42	100.00
Potomac Upper Tidal/Oxon Creek	90.00	60.58	99.49
Piscataway Creek	100.00	74.11	100.00
Seneca Creek	100.00	80.74	100.00
Potomac AL Co/Sideling Hill Creek	100.00	60.70	100.00
Potomac River Upper North Branch	30.00	8.73	60.66
Youghiogheny River	25.00	9.03	48.44

Table B-19. Total Instream Woody Debris + Instream Rootwads					
PSU	**Mean**	**Median**	**Standard Dev.**	**Minimum**	**Maximum**
Deer Creek	2.36	2.00	2.13	0.00	7.00
Upper Pocomoke River	6.00	4.00	6.44	0.00	19.00
Dividing Creek/Nassawango Creek	6.10	1.00	7.72	0.00	19.00
Nanticoke River	10.78	9.00	9.19	0.00	26.00
Northeast River/Furnace Bay	6.44	3.00	7.32	1.00	19.00
Sasssafras River/Stillpond-Fairlee	6.22	8.00	5.14	0.00	13.00
Little Gunpowder Falls	1.00	1.00	1.25	0.00	4.00
Bodkin Creek/Baltimore Harbor	3.80	3.00	4.10	0.00	13.00
Patuxent River Middle	6.92	5.00	4.05	2.00	16.00
Western Branch	8.44	9.00	4.28	1.00	14.00
Assawoman/Isle of Wight/Sinepuxent/ Newport/Chincoteague Bays	2.86	1.00	4.26	0.00	10.00
Gilbert Swamp	4.70	3.50	4.52	0.00	13.00
Zekiah Swamp	25.23	7.00	40.20	3.00	118.00
Potomac Upper Tidal/Oxon Creek	4.50	5.00	3.41	0.00	9.00
Piscataway Creek	4.70	4.00	2.36	2.00	9.00
Seneca Creek	4.29	4.50	2.33	0.00	8.00
Potomac AL Co/Sideling Hill Creek	1.00	1.00	0.82	0.00	2.00
Potomac River Upper North Branch	7.60	4.50	7.56	2.00	26.00
Youghiogheny River	5.75	5.00	4.09	0.00	14.00

Table B-20. Instream Woody Debris					
PSU	**Mean**	**Median**	**Standard Dev.**	**Minimum**	**Maximum**
Deer Creek	1.86	1.50	1.96	0.00	7.00
Upper Pocomoke River	5.25	3.50	5.46	0.00	16.00
Dividing Creek/Nassawango Creek	4.10	0.50	5.61	0.00	13.00
Nanticoke River	5.67	7.00	5.12	0.00	14.00
Northeast River/Furnace Bay	4.89	2.00	6.49	0.00	17.00
Sasssafras River/Stillpond-Fairlee	5.11	5.00	4.26	0.00	11.00
Little Gunpowder Falls	0.80	0.50	1.23	0.00	4.00
Bodkin Creek/Baltimore Harbor	1.50	1.00	1.43	0.00	4.00
Patuxent River Middle	4.31	4.00	2.84	0.00	10.00
Western Branch	5.33	5.00	3.32	0.00	10.00
Assawoman/Isle of Wight/Sinepuxent/ Newport/Chincoteague Bays	1.57	1.00	2.07	0.00	5.00
Gilbert Swamp	2.80	1.50	4.10	0.00	13.00
Zekiah Swamp	12.92	5.00	17.99	1.00	53.00
Potomac Upper Tidal/Oxon Creek	1.30	1.00	0.82	0.00	3.00
Piscataway Creek	2.00	2.00	1.94	0.00	6.00
Seneca Creek	2.71	2.50	1.82	0.00	5.00
Potomac AL Co/Sideling Hill Creek	1.00	1.00	0.89	0.00	2.00
Potomac River Upper North Branch	5.50	3.50	5.56	1.00	19.00
Youghiogheny River	4.00	2.50	3.67	0.00	14.00

Table B-21. Dewatered Woody Debris					
PSU	**Mean**	**Median**	**Standard Dev.**	**Minimum**	**Maximum**
Deer Creek	7.71	6.00	10.74	0.00	43.00
Upper Pocomoke River	2.58	1.00	3.50	0.00	10.00
Dividing Creek/Nassawango Creek	4.10	0.00	7.46	0.00	23.00
Nanticoke River	2.67	1.00	3.20	0.00	10.00
Northeast River/Furnace Bay	6.33	6.00	4.82	0.00	14.00
Sasssafras River/Stillpond-Fairlee	4.78	5.00	3.53	0.00	10.00
Little Gunpowder Falls	3.40	3.50	2.63	0.00	7.00
Bodkin Creek/Baltimore Harbor	2.70	1.00	3.89	0.00	12.00
Patuxent River Middle	5.54	5.00	3.60	1.00	15.00
Western Branch	5.89	4.00	4.91	0.00	14.00
Assawoman/Isle of Wight/Sinepuxent/ Newport/Chincoteague Bays	2.00	0.00	4.12	0.00	11.00
Gilbert Swamp	2.50	2.00	2.64	0.00	7.00
Zekiah Swamp	12.69	7.00	17.49	2.00	60.00
Potomac Upper Tidal/Oxon Creek	3.60	3.50	3.13	0.00	8.00
Piscataway Creek	3.90	3.50	2.73	0.00	9.00
Seneca Creek	3.79	4.00	1.81	0.00	6.00
Potomac AL Co/Sideling Hill Creek	6.00	3.00	7.32	1.00	20.00
Potomac River Upper North Branch	9.70	8.50	4.35	5.00	18.00
Youghiogheny River	5.56	5.50	3.97	0.00	12.00

Table B-22. Total Woody Debris					
PSU	**Mean**	**Median**	**Standard Dev.**	**Minimum**	**Maximum**
Deer Creek	9.57	6.50	11.26	0.00	45.00
Upper Pocomoke River	7.83	5.50	8.74	0.00	24.00
Dividing Creek/Nassawango Creek	8.20	0.50	12.43	0.00	35.00
Nanticoke River	8.33	9.00	6.63	0.00	18.00
Northeast River/Furnace Bay	11.22	8.00	9.83	1.00	28.00
Sasssafras River/Stillpond-Fairlee	9.89	12.00	7.37	0.00	21.00
Little Gunpowder Falls	4.20	4.00	3.36	0.00	9.00
Bodkin Creek/Baltimore Harbor	4.20	3.00	4.83	0.00	15.00
Patuxent River Middle	9.85	9.00	5.35	3.00	23.00
Western Branch	11.22	10.00	7.24	0.00	19.00
Assawoman/Isle of Wight/Sinepuxent/ Newport/Chincoteague Bays	3.57	1.00	5.80	0.00	15.00
Gilbert Swamp	5.30	2.00	6.40	0.00	20.00
Zekiah Swamp	25.62	12.00	35.12	4.00	113.00
Potomac Upper Tidal/Oxon Creek	4.90	5.50	3.45	0.00	9.00
Piscataway Creek	5.90	6.50	3.73	1.00	11.00
Seneca Creek	6.50	6.00	3.16	0.00	11.00
Potomac AL Co/Sideling Hill Creek	7.00	3.50	8.00	1.00	22.00
Potomac River Upper North Branch	15.20	13.50	7.02	8.00	33.00
Youghiogheny River	9.56	8.50	5.81	0.00	20.00

Table B-23. Instream Rootwads					
PSU	**Mean**	**Median**	**Standard Dev.**	**Minimum**	**Maximum**
Deer Creek	0.50	0.00	0.65	0.00	2.00
Upper Pocomoke River	0.75	0.00	1.22	0.00	3.00
Dividing Creek/Nassawango Creek	2.00	0.00	3.09	0.00	8.00
Nanticoke River	5.11	5.00	4.70	0.00	12.00
Northeast River/Furnace Bay	1.56	1.00	1.01	1.00	4.00
Sasssafras River/Stillpond-Fairlee	1.11	1.00	1.17	0.00	3.00
Little Gunpowder Falls	0.20	0.00	0.42	0.00	1.00
Bodkin Creek/Baltimore Harbor	2.30	0.50	3.30	0.00	10.00
Patuxent River Middle	2.62	2.00	1.71	1.00	6.00
Western Branch	3.11	2.00	2.52	1.00	7.00
Assawoman/Isle of Wight/Sinepuxent/ Newport/Chincoteague Bays	1.29	0.00	2.21	0.00	5.00
Gilbert Swamp	1.90	1.00	2.42	0.00	8.00
Zekiah Swamp	12.31	3.00	22.41	1.00	65.00
Potomac Upper Tidal/Oxon Creek	3.20	3.00	3.01	0.00	8.00
Piscataway Creek	2.70	2.50	1.06	1.00	4.00
Seneca Creek	1.57	1.50	1.45	0.00	5.00
Potomac AL Co/Sideling Hill Creek	0.17	0.00	0.41	0.00	1.00
Potomac River Upper North Branch	2.10	1.00	2.42	0.00	7.00
Youghiogheny River	1.75	0.50	2.11	0.00	5.00

Table B-24. Dewatered Rootwads					
PSU	**Mean**	**Median**	**Standard Dev.**	**Minimum**	**Maximum**
Deer Creek	6.93	5.00	6.98	0.00	26.00
Upper Pocomoke River	4.00	2.50	4.37	0.00	11.00
Dividing Creek/Nassawango Creek	2.10	0.00	3.96	0.00	10.00
Nanticoke River	6.33	4.00	6.34	1.00	21.00
Northeast River/Furnace Bay	4.56	6.00	3.17	0.00	8.00
Sasssafras River/Stillpond-Fairlee	1.44	0.00	2.13	0.00	5.00
Little Gunpowder Falls	1.80	1.00	1.69	0.00	5.00
Bodkin Creek/Baltimore Harbor	3.30	2.00	4.08	0.00	14.00
Patuxent River Middle	5.31	3.00	5.62	0.00	19.00
Western Branch	5.11	3.00	5.53	0.00	15.00
Assawoman/Isle of Wight/Sinepuxent/ Newport/Chincoteague Bays	1.43	0.00	3.78	0.00	10.00
Gilbert Swamp	2.00	1.00	2.49	0.00	8.00
Zekiah Swamp	10.15	5.00	17.80	0.00	67.00
Potomac Upper Tidal/Oxon Creek	3.10	1.50	4.93	0.00	16.00
Piscataway Creek	2.50	2.00	1.78	1.00	6.00
Seneca Creek	4.50	4.00	3.50	0.00	12.00
Potomac AL Co/Sideling Hill Creek	4.00	3.00	4.69	0.00	11.00
Potomac River Upper North Branch	6.40	6.00	4.33	1.00	14.00
Youghiogheny River	3.25	2.00	2.86	0.00	7.00

Table B-25. Total Rootwads					
PSU	**Mean**	**Median**	**Standard Dev.**	**Minimum**	**Maximum**
Deer Creek	7.43	6.00	7.07	0.00	27.00
Upper Pocomoke River	4.75	4.00	5.05	0.00	11.00
Dividing Creek/Nassawango Creek	4.10	0.50	5.61	0.00	16.00
Nanticoke River	11.44	12.00	6.88	1.00	22.00
Northeast River/Furnace Bay	6.11	7.00	3.33	1.00	10.00
Sasssafras River/Stillpond-Fairlee	2.56	2.00	2.96	0.00	8.00
Little Gunpowder Falls	2.00	1.50	1.70	0.00	5.00
Bodkin Creek/Baltimore Harbor	5.60	4.00	6.20	0.00	19.00
Patuxent River Middle	7.92	7.00	5.66	1.00	21.00
Western Branch	8.22	6.00	6.94	1.00	22.00
Assawoman/Isle of Wight/Sinepuxent/ Newport/Chincoteague Bays	2.71	0.00	5.31	0.00	14.00
Gilbert Swamp	3.90	3.50	2.88	1.00	9.00
Zekiah Swamp	22.46	7.00	37.74	2.00	127.00
Potomac Upper Tidal/Oxon Creek	6.30	4.50	7.29	0.00	24.00
Piscataway Creek	5.20	5.50	1.75	3.00	8.00
Seneca Creek	6.07	6.50	3.85	0.00	13.00
Potomac AL Co/Sideling Hill Creek	4.17	3.00	4.83	0.00	11.00
Potomac River Upper North Branch	8.50	9.00	4.53	1.00	15.00
Youghiogheny River	5.00	4.00	4.35	0.00	11.00

Table B-26. Total Nitrogen (mg/l)					
PSU	**Mean**	**Median**	**Standard Dev.**	**Minimum**	**Maximum**
Deer Creek	4.77	3.99	2.44	1.78	9.96
Upper Pocomoke River	2.97	2.13	2.13	0.31	6.28
Dividing Creek/Nassawango Creek	1.05	1.01	0.58	0.31	1.90
Nanticoke River	5.23	4.75	3.28	0.23	12.18
Northeast River/Furnace Bay	2.94	3.38	1.54	0.14	4.91
Sasssafras River/Stillpond-Fairlee	3.18	3.01	2.25	1.02	8.45
Little Gunpowder Falls	3.02	2.93	1.10	0.62	4.69
Bodkin Creek/Baltimore Harbor	1.34	1.48	0.73	0.31	2.39
Patuxent River Middle	1.32	1.26	0.72	0.13	2.33
Western Branch	0.93	0.84	0.43	0.49	1.87
Assawoman/Isle of Wight/Sinepuxent/ Newport/Chincoteague Bays	3.09	2.10	2.73	0.69	9.64
Gilbert Swamp	1.31	1.28	0.83	0.13	2.90
Zekiah Swamp	0.71	0.45	0.59	0.17	2.19
Potomac Upper Tidal/Oxon Creek	0.93	1.05	0.37	0.36	1.46
Piscataway Creek	1.01	0.89	0.80	0.26	2.99
Seneca Creek	3.31	2.72	2.17	0.31	8.59
Potomac AL Co/Sideling Hill Creek	0.69	0.70	0.43	0.13	1.45
Potomac River Upper North Branch	0.52	0.65	0.24	0.18	0.77
Youghiogheny River	0.95	0.81	0.69	0.16	3.01

Table B-27. Nitrate Nitrogen (mg/l)					
PSU	**Mean**	**Median**	**Standard Dev.**	**Minimum**	**Maximum**
Deer Creek	4.37	3.48	2.38	1.62	9.91
Upper Pocomoke River	2.26	1.46	1.93	0.10	5.32
Dividing Creek/Nassawango Creek	0.65	0.61	0.47	0.00	1.45
Nanticoke River	4.85	4.24	3.31	0.12	12.14
Northeast River/Furnace Bay	2.57	2.90	1.39	0.11	4.43
Sasssafras River/Stillpond-Fairlee	2.50	2.13	2.47	0.10	8.40
Little Gunpowder Falls	2.61	2.57	0.96	0.49	4.10
Bodkin Creek/Baltimore Harbor	0.93	1.12	0.63	0.00	1.76
Patuxent River Middle	1.10	1.05	0.65	0.00	2.04
Western Branch	0.52	0.40	0.28	0.24	1.00
Assawoman/Isle of Wight/Sinepuxent/ Newport/Chincoteague Bays	2.22	1.64	1.95	0.10	6.17
Gilbert Swamp	1.02	0.96	0.72	0.00	2.49
Zekiah Swamp	0.55	0.32	0.51	0.00	1.78
Potomac Upper Tidal/Oxon Creek	0.65	0.75	0.30	0.00	1.02
Piscataway Creek	0.62	0.47	0.32	0.26	1.12
Seneca Creek	3.04	2.37	2.22	0.15	8.59
Potomac AL Co/Sideling Hill Creek	0.61	0.63	0.41	0.00	1.35
Potomac River Upper North Branch	0.50	0.63	0.22	0.15	0.71
Youghiogheny River	0.87	0.78	0.62	0.18	2.72

Table B-28. Nitrite Nitrogen (mg/l)					
PSU	**Mean**	**Median**	**Standard Dev.**	**Minimum**	**Maximum**
Deer Creek	0.006	0.004	0.005	0.000	0.014
Upper Pocomoke River	0.009	0.008	0.004	0.004	0.018
Dividing Creek/Nassawango Creek	0.003	0.002	0.002	0.000	0.007
Nanticoke River	0.005	0.004	0.003	0.000	0.011
Northeast River/Furnace Bay	0.014	0.013	0.010	0.000	0.031
Sasssafras River/Stillpond-Fairlee	0.011	0.013	0.005	0.004	0.020
Little Gunpowder Falls	0.006	0.004	0.003	0.002	0.011
Bodkin Creek/Baltimore Harbor	0.008	0.005	0.006	0.001	0.020
Patuxent River Middle	0.003	0.003	0.003	0.000	0.012
Western Branch	0.004	0.003	0.004	0.000	0.013
Assawoman/Isle of Wight/Sinepuxent/ Newport/Chincoteague Bays	0.013	0.008	0.018	0.004	0.059
Gilbert Swamp	0.003	0.003	0.003	0.001	0.010
Zekiah Swamp	0.003	0.002	0.003	0.000	0.010
Potomac Upper Tidal/Oxon Creek	0.003	0.001	0.004	0.000	0.012
Piscataway Creek	0.006	0.003	0.009	0.000	0.029
Seneca Creek	0.015	0.006	0.024	0.001	0.077
Potomac AL Co/Sideling Hill Creek	0.001	0.001	0.000	0.000	0.001
Potomac River Upper North Branch	0.001	0.001	0.002	0.000	0.005
Youghiogheny River	0.002	0.002	0.001	0.000	0.003

Table B-29. Ammonia (mg/l)					
PSU	**Mean**	**Median**	**Standard Dev.**	**Minimum**	**Maximum**
Deer Creek	0.006	0.005	0.004	0.002	0.016
Upper Pocomoke River	0.061	0.028	0.070	0.014	0.235
Dividing Creek/Nassawango Creek	0.018	0.012	0.016	0.004	0.053
Nanticoke River	0.048	0.015	0.103	0.004	0.339
Northeast River/Furnace Bay	0.025	0.017	0.020	0.004	0.062
Sasssafras River/Stillpond-Fairlee	0.176	0.093	0.189	0.041	0.634
Little Gunpowder Falls	0.033	0.013	0.062	0.005	0.210
Bodkin Creek/Baltimore Harbor	0.095	0.055	0.101	0.003	0.314
Patuxent River Middle	0.051	0.049	0.021	0.019	0.088
Western Branch	0.080	0.059	0.102	0.006	0.365
Assawoman/Isle of Wight/Sinepuxent/ Newport/Chincoteague Bays	0.307	0.023	0.846	0.012	2.562
Gilbert Swamp	0.031	0.026	0.021	0.007	0.060
Zekiah Swamp	0.032	0.018	0.045	0.002	0.177
Potomac Upper Tidal/Oxon Creek	0.066	0.043	0.061	0.007	0.166
Piscataway Creek	0.248	0.031	0.690	0.004	2.212
Seneca Creek	0.048	0.013	0.103	0.002	0.408
Potomac AL Co/Sideling Hill Creek	0.002	0.002	0.000	0.002	0.002
Potomac River Upper North Branch	0.009	0.005	0.009	0.002	0.029
Youghiogheny River	0.009	0.006	0.011	0.002	0.048

Table B-30. Nitrate Nitrogen > 1 mg/l			
PSU	**Percentage of Stream Miles with NO3 > 1 mg/L**	**Lower 90% CI**	**Upper 90% CI**
Deer Creek	100.00	80.74	100.00
Upper Pocomoke River	61.54	35.48	83.43
Dividing Creek/Nassawango Creek	30.00	8.73	53.84
Nanticoke River	90.00	60.58	99.49
Northeast River/Furnace Bay	80.00	49.31	96.32
Sasssafras River/Stillpond-Fairlee	66.67	34.49	90.23
Little Gunpowder Falls	90.00	60.58	99.49
Bodkin Creek/Baltimore Harbor	50.00	22.24	77.78
Patuxent River Middle	53.85	28.70	77.60
Western Branch	10.00	0.51	39.42
Assawoman/Isle of Wight/Sinepuxent/ Newport/Chincoteague Bays	66.67	34.49	90.23
Gilbert Swamp	40.00	15.00	68.65
Zekiah Swamp	15.38	2.81	41.01
Potomac Upper Tidal/Oxon Creek	10.00	0.51	39.42
Piscataway Creek	10.00	0.51	39.42
Seneca Creek	86.67	63.66	97.58
Potomac AL Co/Sideling Hill Creek	20.00	3.68	50.69
Potomac River Upper North Branch	0.00	0.00	25.89
Youghiogheny River	31.25	13.21	54.83

Table B-31. Total Phosphorus (mg/l)					
PSU	**Mean**	**Median**	**Standard Dev.**	**Minimum**	**Maximum**
Deer Creek	0.023	0.017	0.018	0.008	0.073
Upper Pocomoke River	0.072	0.053	0.060	0.010	0.194
Dividing Creek/Nassawango Creek	0.040	0.018	0.059	0.006	0.203
Nanticoke River	0.014	0.014	0.005	0.008	0.022
Northeast River/Furnace Bay	0.051	0.053	0.029	0.007	0.090
Sasssafras River/Stillpond-Fairlee	0.112	0.104	0.052	0.045	0.198
Little Gunpowder Falls	0.018	0.013	0.010	0.006	0.031
Bodkin Creek/Baltimore Harbor	0.019	0.017	0.006	0.013	0.031
Patuxent River Middle	0.077	0.082	0.037	0.011	0.143
Western Branch	0.053	0.052	0.022	0.024	0.086
Assawoman/Isle of Wight/Sinepuxent/ Newport/Chincoteague Bays	0.264	0.060	0.490	0.017	1.515
Gilbert Swamp	0.029	0.026	0.012	0.012	0.051
Zekiah Swamp	0.026	0.021	0.021	0.012	0.094
Potomac Upper Tidal/Oxon Creek	0.018	0.014	0.011	0.007	0.044
Piscataway Creek	0.048	0.038	0.044	0.014	0.167
Seneca Creek	0.025	0.014	0.025	0.007	0.095
Potomac AL Co/Sideling Hill Creek	0.006	0.006	0.002	0.004	0.011
Potomac River Upper North Branch	0.009	0.006	0.009	0.004	0.033
Youghiogheny River	0.010	0.009	0.005	0.004	0.021

Table B-32. Orthophosphate (mg/l)					
PSU	**Mean**	**Median**	**Standard Dev.**	**Minimum**	**Maximum**
Deer Creek	0.008	0.006	0.009	0.001	0.031
Upper Pocomoke River	0.029	0.010	0.044	0.001	0.131
Dividing Creek/Nassawango Creek	0.019	0.002	0.042	0.001	0.137
Nanticoke River	0.003	0.002	0.002	0.001	0.007
Northeast River/Furnace Bay	0.031	0.029	0.024	0.001	0.069
Sasssafras River/Stillpond-Fairlee	0.004	0.003	0.004	0.001	0.011
Little Gunpowder Falls	0.007	0.007	0.007	0.001	0.023
Bodkin Creek/Baltimore Harbor	0.007	0.005	0.009	0.001	0.031
Patuxent River Middle	0.007	0.006	0.008	0.001	0.033
Western Branch	0.006	0.006	0.006	0.001	0.021
Assawoman/Isle of Wight/Sinepuxent/ Newport/Chincoteague Bays	0.200	0.039	0.394	0.001	1.205
Gilbert Swamp	0.009	0.009	0.006	0.001	0.018
Zekiah Swamp	0.010	0.008	0.010	0.001	0.029
Potomac Upper Tidal/Oxon Creek	0.001	0.001	0.001	0.001	0.004
Piscataway Creek	0.003	0.002	0.004	0.001	0.013
Seneca Creek	0.012	0.001	0.024	0.001	0.082
Potomac AL Co/Sideling Hill Creek	0.001	0.001	0.000	0.001	0.001
Potomac River Upper North Branch	0.001	0.001	0.000	0.001	0.001
Youghiogheny River	0.002	0.001	0.001	0.001	0.005

Table B-33. Dissolved Oxygen (mg/l)					
PSU	**Mean**	**Median**	**Standard Dev.**	**Minimum**	**Maximum**
Deer Creek	8.65	8.80	0.73	7.30	10.20
Upper Pocomoke River	4.99	4.70	2.68	1.30	9.20
Dividing Creek/Nassawango Creek	6.01	6.45	2.06	2.90	8.10
Nanticoke River	6.83	7.30	1.64	4.20	9.60
Northeast River/Furnace Bay	7.98	8.00	0.74	6.80	9.60
Sasssafras River/Stillpond-Fairlee	5.81	6.20	1.96	1.60	8.60
Little Gunpowder Falls	8.41	8.90	1.03	6.00	9.40
Bodkin Creek/Baltimore Harbor	5.25	5.75	2.88	0.30	8.60
Patuxent River Middle	7.97	8.20	0.93	6.50	9.40
Western Branch	5.80	6.90	2.42	1.90	8.20
Assawoman/Isle of Wight/Sinepuxent/ Newport/Chincoteague Bays	6.14	6.70	1.23	3.90	7.70
Gilbert Swamp	7.60	7.70	1.58	4.10	9.40
Zekiah Swamp	6.77	7.30	2.06	0.40	8.20
Potomac Upper Tidal/Oxon Creek	7.18	7.40	1.81	2.30	8.80
Piscataway Creek	6.78	6.60	1.53	3.60	9.50
Seneca Creek	8.30	8.40	1.09	6.50	10.10
Potomac AL Co/Sideling Hill Creek	8.17	8.20	0.56	7.50	8.70
Potomac River Upper North Branch	9.54	9.65	1.88	7.00	12.70
Youghiogheny River	7.96	8.25	1.25	4.80	9.80

Table B-34. Dissolved Oxygen < 5 mg/l			
PSU	**Percentage of Stream Miles with DO < 5 mg/L**	**Lower 90% CI**	**Upper 90% CI**
Deer Creek	0	0	19.26
Upper Pocomoke River	58.33	31.52	91.9
Dividing Creek/Nassawango Creek	42.86	12.88	77.47
Nanticoke River	22.22	4.1	54.96
Northeast River/Furnace Bay	0	0	28.31
Sasssafras River/Stillpond-Fairlee	22.22	4.1	54.96
Little Gunpowder Falls	0	0	25.89
Bodkin Creek/Baltimore Harbor	40	15	69.65
Patuxent River Middle	0	0	20.58
Western Branch	33.33	9.77	65.51
Assawoman/Isle of Wight/Sinepuxent/ Newport/Chincoteague Bays	14.29	0.73	52.07
Gilbert Swamp	10	0.51	39.42
Zekiah Swamp	7.69	0.39	31.63
Potomac Upper Tidal/Oxon Creek	10	0.51	39.42
Piscataway Creek	10	0.51	39.42
Seneca Creek	0	0	19.26
Potomac AL Co/Sideling Hill Creek	0	0	39.3
Potomac River Upper North Branch	0	0	25.89
Youghiogheny River	6.25	0.32	26.4

Table B-35. Turbidity (NTU)					
PSU	**Mean**	**Median**	**Standard Dev.**	**Minimum**	**Maximum**
Deer Creek	3.79	2.65	2.42	1.70	9.00
Upper Pocomoke River	17.32	10.25	19.43	6.40	76.00
Dividing Creek/Nassawango Creek	22.22	5.95	45.42	2.70	150.00
Nanticoke River	40.37	2.80	112.38	0.90	340.00
Northeast River/Furnace Bay	6.51	5.60	3.24	3.90	12.20
Sasssafras River/Stillpond-Fairlee	15.41	15.40	9.50	3.10	32.00
Little Gunpowder Falls	4.20	2.00	4.72	0.70	13.00
Bodkin Creek/Baltimore Harbor	10.46	11.35	4.61	3.10	18.10
Patuxent River Middle	15.91	14.00	10.48	1.00	40.50
Western Branch	18.58	9.40	29.16	4.40	95.40
Assawoman/Isle of Wight/Sinepuxent/ Newport/Chincoteague Bays	14.26	7.00	19.27	4.60	57.80
Gilbert Swamp	9.84	5.20	14.49	2.50	50.80
Zekiah Swamp	7.78	6.90	4.79	2.70	20.30
Potomac Upper Tidal/Oxon Creek	9.50	9.35	6.55	2.10	22.80
Piscataway Creek	7.76	6.50	4.98	1.20	16.60
Seneca Creek	5.47	3.30	5.11	1.20	19.70
Potomac AL Co/Sideling Hill Creek	3.57	3.25	1.47	2.30	6.40
Potomac River Upper North Branch	4.48	3.35	4.69	1.70	17.50
Youghiogheny River	5.24	4.15	3.91	0.60	13.60

Table B-36. Sulfate (mg/l)					
PSU	**Mean**	**Median**	**Standard Dev.**	**Minimum**	**Maximum**
Deer Creek	6.32	6.26	1.94	3.49	9.02
Upper Pocomoke River	17.42	15.83	8.99	5.30	44.70
Dividing Creek/Nassawango Creek	10.14	9.20	2.35	7.42	14.26
Nanticoke River	10.15	9.13	6.19	3.50	25.70
Northeast River/Furnace Bay	11.02	11.28	1.78	7.11	13.41
Sasssafras River/Stillpond-Fairlee	13.86	13.02	6.09	6.86	21.99
Little Gunpowder Falls	6.64	7.18	3.14	2.47	11.43
Bodkin Creek/Baltimore Harbor	23.98	22.41	8.16	13.94	36.80
Patuxent River Middle	27.07	26.72	6.20	14.90	40.13
Western Branch	28.70	26.21	11.55	17.58	54.73
Assawoman/Isle of Wight/Sinepuxent/ Newport/Chincoteague Bays	22.37	23.62	8.05	6.50	34.49
Gilbert Swamp	12.95	12.67	2.29	8.93	17.18
Zekiah Swamp	70.91	10.69	218.37	6.98	797.66
Potomac Upper Tidal/Oxon Creek	26.33	26.55	11.25	9.65	47.34
Piscataway Creek	21.39	20.31	3.81	16.62	29.00
Seneca Creek	10.77	7.81	8.68	2.37	31.90
Potomac AL Co/Sideling Hill Creek	12.45	11.88	1.63	10.77	14.99
Potomac River Upper North Branch	60.82	45.14	49.08	11.05	136.19
Youghiogheny River	9.45	8.51	3.12	5.76	15.64

Table B-37. Chloride (mg/l)					
PSU	**Mean**	**Median**	**Standard Dev.**	**Minimum**	**Maximum**
Deer Creek	17.69	16.93	6.87	7.22	28.78
Upper Pocomoke River	18.07	16.59	5.99	10.13	30.42
Dividing Creek/Nassawango Creek	10.47	8.93	4.93	5.16	20.51
Nanticoke River	10.86	11.61	2.67	5.84	14.23
Northeast River/Furnace Bay	23.83	21.92	6.50	16.16	34.16
Sasssafras River/Stillpond-Fairlee	15.78	16.00	5.79	7.55	27.65
Little Gunpowder Falls	27.83	26.31	13.72	10.19	59.22
Bodkin Creek/Baltimore Harbor	259.50	119.87	359.42	63.03	1195.37
Patuxent River Middle	22.23	20.64	8.68	3.79	37.32
Western Branch	44.92	37.09	23.92	17.58	77.52
Assawoman/Isle of Wight/Sinepuxent/ Newport/Chincoteague Bays	64.52	32.52	91.14	11.96	313.25
Gilbert Swamp	10.11	10.72	3.10	3.39	13.03
Zekiah Swamp	42.29	9.66	100.11	4.15	373.21
Potomac Upper Tidal/Oxon Creek	59.21	48.59	44.20	4.39	147.66
Piscataway Creek	45.21	37.06	29.43	12.63	110.91
Seneca Creek	56.27	45.99	42.16	6.98	165.99
Potomac AL Co/Sideling Hill Creek	8.06	2.02	14.14	1.15	47.33
Potomac River Upper North Branch	10.95	7.02	11.62	0.77	29.41
Youghiogheny River	26.39	9.28	35.70	0.90	118.90

Table B-38. Dissolved Organic Carbon (mg/l)					
PSU	**Mean**	**Median**	**Standard Dev.**	**Minimum**	**Maximum**
Deer Creek	1.17	1.06	0.51	0.46	2.46
Upper Pocomoke River	14.57	14.01	6.24	7.58	32.88
Dividing Creek/Nassawango Creek	11.36	10.95	4.84	5.59	19.68
Nanticoke River	4.01	3.19	2.95	1.40	11.64
Northeast River/Furnace Bay	3.55	3.67	0.99	2.12	5.26
Sasssafras River/Stillpond-Fairlee	6.44	4.01	7.40	0.83	23.87
Little Gunpowder Falls	1.65	1.53	0.63	0.83	2.71
Bodkin Creek/Baltimore Harbor	3.71	3.27	1.48	1.89	5.77
Patuxent River Middle	2.10	2.15	0.74	1.12	3.38
Western Branch	4.71	3.40	3.39	1.62	10.45
Assawoman/Isle of Wight/Sinepuxent/ Newport/Chincoteague Bays	12.00	8.80	8.76	6.83	32.63
Gilbert Swamp	3.11	3.37	0.96	1.74	4.48
Zekiah Swamp	3.12	3.35	1.03	1.45	4.69
Potomac Upper Tidal/Oxon Creek	3.03	2.64	2.25	1.27	9.08
Piscataway Creek	2.72	2.59	1.17	1.47	4.75
Seneca Creek	2.00	1.18	1.28	0.71	4.78
Potomac AL Co/Sideling Hill Creek	1.70	1.75	0.16	1.39	1.88
Potomac River Upper North Branch	0.76	0.65	0.29	0.45	1.25
Youghiogheny River	1.01	0.98	0.41	0.48	1.78

Table B-39. Percentage Urban Land Use (in catchments upstream of sites)					
PSU	**Mean**	**Median**	**Standard Dev.**	**Minimum**	**Maximum**
Deer Creek	0.55	0.16	0.90	0.00	3.39
Upper Pocomoke River	1.97	0.60	2.51	0.00	7.56
Dividing Creek/Nassawango Creek	0.37	0.00	0.78	0.00	2.27
Nanticoke River	1.10	0.35	1.45	0.00	3.72
Northeast River/Furnace Bay	0.81	0.41	1.11	0.00	3.62
Sasssafras River/Stillpond-Fairlee	0.69	0.67	0.47	0.00	1.60
Little Gunpowder Falls	7.26	3.62	9.57	0.15	31.71
Bodkin Creek/Baltimore Harbor	59.15	61.74	23.89	7.62	88.18
Patuxent River Middle	5.77	4.46	5.88	0.00	20.36
Western Branch	16.43	8.15	15.44	0.11	41.37
Assawoman/Isle of Wight/Sinepuxent/ Newport/Chincoteague Bays	3.23	0.12	5.28	0.00	14.93
Gilbert Swamp	10.51	8.46	7.83	0.68	23.52
Zekiah Swamp	4.91	5.11	3.54	0.00	10.19
Potomac Upper Tidal/Oxon Creek	41.14	51.35	24.82	0.00	65.08
Piscataway Creek	34.38	28.03	20.98	11.51	70.10
Seneca Creek	10.19	3.59	16.59	0.00	51.30
Potomac AL Co/Sideling Hill Creek	0.17	0.00	0.27	0.00	0.58
Potomac River Upper North Branch	0.06	0.06	0.05	0.00	0.15
Youghiogheny River	0.54	0.13	1.34	0.00	5.48

Table B-40. Percentage Impervious Surface (in catchments upstream of sites)					
PSU	**Mean**	**Median**	**Standard Dev.**	**Minimum**	**Maximum**
Deer Creek	0.16	0.06	0.23	0.00	0.85
Upper Pocomoke River	0.85	0.40	0.99	0.00	2.74
Dividing Creek/Nassawango Creek	0.20	0.00	0.42	0.00	1.23
Nanticoke River	0.55	0.25	0.68	0.00	2.01
Northeast River/Furnace Bay	0.35	0.18	0.52	0.00	1.74
Sasssafras River/Stillpond-Fairlee	0.31	0.23	0.24	0.00	0.80
Little Gunpowder Falls	2.01	1.12	2.44	0.05	8.01
Bodkin Creek/Baltimore Harbor	23.47	22.90	11.59	2.16	46.90
Patuxent River Middle	1.76	1.26	1.80	0.00	6.56
Western Branch	5.32	2.44	5.26	0.08	15.26
Assawoman/Isle of Wight/Sinepuxent/ Newport/Chincoteague Bays	1.34	0.03	2.22	0.00	6.42
Gilbert Swamp	3.19	2.62	2.51	0.23	7.87
Zekiah Swamp	1.52	1.43	1.11	0.00	3.28
Potomac Upper Tidal/Oxon Creek	14.34	16.48	9.92	0.00	26.04
Piscataway Creek	11.26	8.64	8.05	3.09	26.02
Seneca Creek	3.12	0.94	5.28	0.00	18.21
Potomac AL Co/Sideling Hill Creek	0.05	0.00	0.08	0.00	0.16
Potomac River Upper North Branch	0.02	0.01	0.01	0.00	0.04
Youghiogheny River	0.16	0.04	0.37	0.00	1.53

Table B-41. Percentage Agricultural Land Use (in catchments upstream of sites)					
PSU	**Mean**	**Median**	**Standard Dev.**	**Minimum**	**Maximum**
Deer Creek	68.66	69.49	14.42	39.57	100.00
Upper Pocomoke River	47.70	51.87	23.91	0.97	87.01
Dividing Creek/Nassawango Creek	23.97	24.43	11.28	1.61	35.50
Nanticoke River	63.78	66.05	15.36	31.24	79.84
Northeast River/Furnace Bay	65.01	76.08	29.44	3.51	86.43
Sasssafras River/Stillpond-Fairlee	80.80	83.50	6.54	62.78	87.46
Little Gunpowder Falls	54.43	56.27	19.35	17.42	78.50
Bodkin Creek/Baltimore Harbor	18.10	12.52	14.85	4.61	53.91
Patuxent River Middle	50.47	52.87	17.14	24.05	72.10
Western Branch	42.79	40.85	19.62	17.12	69.73
Assawoman/Isle of Wight/Sinepuxent/ Newport/Chincoteague Bays	53.41	57.50	22.53	0.00	81.93
Gilbert Swamp	35.50	36.40	10.26	13.47	46.92
Zekiah Swamp	32.04	33.52	14.63	6.23	58.56
Potomac Upper Tidal/Oxon Creek	11.88	11.74	5.43	3.58	20.39
Piscataway Creek	20.97	16.66	14.99	3.36	56.46
Seneca Creek	68.21	68.25	21.09	16.99	97.11
Potomac AL Co/Sideling Hill Creek	7.74	1.26	10.49	0.00	23.25
Potomac River Upper North Branch	11.04	9.06	9.26	3.00	34.67
Youghiogheny River	26.32	21.88	17.55	7.89	69.69

Table B-42. Percentage Forested Land Use (in catchments upstream of sites)					
PSU	**Mean**	**Median**	**Standard Dev.**	**Minimum**	**Maximum**
Deer Creek	30.53	30.51	14.41	0.00	60.24
Upper Pocomoke River	49.41	47.28	23.93	12.64	99.03
Dividing Creek/Nassawango Creek	72.53	72.69	9.61	59.62	88.53
Nanticoke River	34.60	31.18	15.84	19.46	68.76
Northeast River/Furnace Bay	32.76	21.65	27.72	12.71	96.49
Sasssafras River/Stillpond-Fairlee	17.54	16.25	6.18	12.25	35.54
Little Gunpowder Falls	37.67	39.93	14.57	19.52	64.24
Bodkin Creek/Baltimore Harbor	15.73	9.77	17.83	1.27	69.57
Patuxent River Middle	42.69	44.56	16.67	21.49	72.45
Western Branch	39.82	43.51	9.48	26.15	53.90
Assawoman/Isle of Wight/Sinepuxent/ Newport/Chincoteague Bays	42.89	36.08	23.67	18.07	100.00
Gilbert Swamp	53.31	54.75	13.16	31.77	74.66
Zekiah Swamp	61.10	58.98	15.07	37.01	93.77
Potomac Upper Tidal/Oxon Creek	46.10	39.34	26.35	15.21	96.12
Piscataway Creek	46.75	52.64	25.59	11.12	78.49
Seneca Creek	21.37	24.32	11.05	2.89	36.40
Potomac AL Co/Sideling Hill Creek	91.68	98.69	11.37	74.83	100.00
Potomac River Upper North Branch	88.05	89.56	9.19	64.27	96.63
Youghiogheny River	73.61	76.67	17.68	30.10	94.93

APPENDIX C

SUMMARY OF TEMPERATURE LOGGER DATA

Table C-1. Summary indicator statistics calculated from temperature loggers. Notes indicate special circumstances encountered in deploying or retrieving temp logger. Temperatures are in ˚C. Temperature loggers were deployed from about June to September.

Site	Mean Average Daily Temperature	Mean Minimum Daily Temperature	Mean Maximum Daily Temperature	Absolute Maximum	95th Percentile	Percent Exceedences 20 ˚C	Percent Exceedences 23.9 ˚C	Percent Exceedences 32 ˚C	Notes
BALT-103-R-2001									No temperature logger deployed
BALT-104-R-2001	20.66	19.62	21.78	25.64	23.92	65.20	5.13	0.00	
BALT-106-R-2001	19.80	18.48	22.27	29.74	23.19	43.89	2.69	0.00	
BALT-108-R-2001	24.07	23.13	25.31	31.49	29.61	98.64	44.54	0.00	
BALT-110-R-2001									
BALT-113-R-2001	21.00	19.31	23.00	28.40	24.35	70.95	7.94	0.00	
BALT-202-R-2001	20.08	18.07	22.39	25.36	23.46	51.41	2.73	0.00	
BALT-207-R-2001	20.52	20.21	20.89	23.63	22.78	73.29	0.00	0.00	
BALT-214-R-2001	20.71	19.87	21.65	24.89	23.34	73.09	1.40	0.00	
BODK-101-R-2001	17.94	17.65	18.34	21.14	20.48	7.79	0.00	0.00	
CHIN-103-R-2001									No temperature logger deployed
CHIN-112-R-2001									No temperature logger deployed
CHIN-119-R-2001	20.21	19.03	21.58	25.84	22.93	56.77	1.04	0.00	
DEER-101-R-2001	19.74	18.44	20.96	24.76	22.87	50.79	1.33	0.00	
DEER-103-R-2001	16.69	16.05	17.55	22.69	19.89	4.15	0.00	0.00	
DEER-105-R-2001	16.54	15.58	17.47	19.58	18.60	0.00	0.00	0.00	
DEER-106-R-2001	17.82	16.88	18.92	23.19	20.69	13.72	0.00	0.00	
DEER-109-R-2001	18.67	17.74	19.61	23.19	21.35	24.23	0.00	0.00	
DEER-110-R-2001	18.22	17.47	19.14	21.86	20.53	12.12	0.00	0.00	
DEER-112-R-2001	18.09	16.12	20.40	23.64	21.46	19.89	0.00	0.00	
DEER-113-R-2001	17.70	16.40	18.99	23.28	20.62	9.66	0.00	0.00	
DEER-117-R-2001	14.86	14.01	15.99	19.16	16.44	0.00	0.00	0.00	
DEER-207-R-2001	18.54	16.76	20.44	24.14	21.61	23.92	0.21	0.00	
DEER-302-R-2001	22.31	20.24	24.22	28.41	26.27	85.37	26.41	0.00	
DEER-404-R-2001	22.77	20.88	24.84	34.11	26.56	89.52	31.60	0.05	
DEER-408-R-2001	22.94	21.18	24.79	34.11	26.78	90.64	34.32	0.09	
DEER-414-R-2001	23.18	21.54	25.95	38.16	27.01	91.86	35.53	0.63	
DIVI-104-R-2001									
DIVI-107-R-2001									Stream was dry in the summer
DIVI-109-R-2001									No temperature logger deployed
DIVI-110-R-2001									No temperature logger deployed
DIVI-111-R-2001									
DIVI-112-R-2001									No temperature logger deployed
DIVI-119-R-2001	20.73	18.36	25.60	38.09	27.67	60.11	13.36	2.33	
DIVI-218-R-2001	21.40	19.68	23.29	31.66	25.47	73.85	11.96	0.00	
FURN-101-R-2001	18.88	18.01	19.72	24.56	22.17	32.72	0.53	0.00	
FURN-118-R-2001	19.27	18.25	20.33	24.04	22.18	37.01	0.02	0.00	

Table C-1. (Continued)

Site	Mean Average Daily Temperature	Mean Minimum Daily Temperature	Mean Maximum Daily Temperature	Absolute Maximum	95th Percentile	Percent Exceedences 20 ˚C	Percent Exceedences 23.9 ˚C	Percent Exceedences 32 ˚C	Notes
GILB-108-R-2001	19.55	18.41	20.72	24.52	22.15	45.48	0.20	0.00	
GILB-109-R-2001	20.41	19.04	21.82	25.95	23.19	63.46	1.86	0.00	
GILB-111-R-2001	20.17	19.11	21.25	25.39	23.15	59.08	1.77	0.00	
GILB-112-R-2001	19.01	18.38	19.84	23.71	21.19	32.02	0.00	0.00	
GILB-114-R-2001	20.41	19.04	21.82	25.95	23.19	63.46	1.86	0.00	
GILB-115-R-2001	21.47	18.33	24.89	29.95	25.99	72.94	21.95	0.00	
GILB-213-R-2001	18.66	17.90	19.44	22.77	21.60	24.96	0.00	0.00	
GILB-306-R-2001	23.25	21.79	24.78	28.97	26.10	92.45	41.04	0.00	
GILB-307-R-2001	22.71	21.29	24.12	27.78	25.67	89.23	30.67	0.00	
ISLE-105-R-2001	20.40	19.39	21.49	26.21	22.93	64.35	1.07	0.00	Temperature logger data from site 120 is used
ISLE-107-R-2001	20.40	19.39	21.49	26.21	22.93	64.35	1.07	0.00	Temperature logger data from site 120 is used
ISLE-115-R-2001	20.53	19.74	21.26	24.44	23.07	66.87	0.86	0.00	
ISLE-120-R-2001	20.40	19.39	21.49	26.21	22.93	64.35	1.07	0.00	
LIGU-102-R-2001	18.02	16.92	19.14	23.34	20.67	11.05	0.00	0.00	
LIGU-103-R-2001	19.76	18.88	20.67	24.48	22.43	50.08	0.69	0.00	
LIGU-104-R-2001	19.76	19.00	20.53	24.77	22.88	50.42	1.19	0.00	
LIGU-105-R-2001	18.91	18.05	19.74	23.88	21.87	31.48	0.00	0.00	
LIGU-109-R-2001	17.37	17.06	17.75	20.70	19.73	3.19	0.00	0.00	
LIGU-110-R-2001	18.06	16.93	19.59	24.02	20.34	9.41	0.03	0.00	
LIGU-111-R-2001	18.12	16.20	20.80	25.87	22.11	21.64	1.06	0.00	
LIGU-201-R-2001	21.16	18.93	23.56	29.30	25.03	71.42	12.61	0.00	
LIGU-306-R-2001	21.70	20.24	23.16	27.94	25.30	81.67	14.54	0.00	
LIGU-312-R-2001	21.72	20.04	23.54	28.63	25.43	80.10	15.57	0.00	
NANT-102-R-2001	20.43	18.67	22.76	29.21	24.94	61.94	9.56	0.00	
NANT-107-R-2001	23.00	22.08	23.95	28.08	25.43	92.15	25.73	0.00	
NANT-108-R-2001	20.99	19.16	22.77	30.17	24.96	69.61	10.61	0.00	
NANT-110-R-2001	18.50	17.47	19.65	26.23	22.46	15.91	1.42	0.00	
NANT-113-R-2001	19.97	18.87	21.06	25.12	22.73	52.33	0.53	0.00	
NANT-114-R-2001	23.00	22.08	23.95	28.08	25.43	92.15	25.73	0.00	Temperature logger data from site 107 was used
NANT-116-R-2001	21.40	18.93	24.98	34.77	26.47	69.42	17.30	0.09	
NANT-119-R-2001	20.43	18.67	22.76	29.21	24.94	61.94	9.56	0.00	Temperature logger data from site 102 was used
NANT-203-R-2001	18.32	17.61	19.03	22.89	20.73	10.58	0.00	0.00	
NANT-311-R-2001									
NASS-108-R-2001	20.50	18.90	21.89	27.67	24.01	62.28	5.80	0.00	
NASS-206-R-2001	20.36	19.59	21.14	24.76	22.88	59.40	0.48	0.00	
NASS-217-R-2001									
NEAS-103-R-2001	20.29	18.90	21.63	25.67	23.59	61.26	3.71	0.00	
NEAS-107-R-2001	20.93	19.43	22.70	27.04	24.25	71.58	6.30	0.00	

Table C-1. (Continued)

Site	Mean Average Daily Temperature	Mean Minimum Daily Temperature	Mean Maximum Daily Temperature	Absolute Maximum	95th Percentile	Percent Exceedences 20 ˚C	Percent Exceedences 23.9 ˚C	Percent Exceedences 32 ˚C	Notes
NEAS-115-R-2001									Stream was dry in the summer
NEAS-201-R-2001	20.04	18.77	21.33	25.62	23.21	57.77	2.07	0.00	
NEAS-202-R-2001	21.20	19.83	22.37	26.61	24.69	76.26	9.30	0.00	
NEAS-312-R-2001	21.15	20.28	22.07	25.91	24.35	78.56	7.66	0.00	
NEWP-110-R-2001									Stream was dry in the summer
NEWP-116-R-2001	22.46	20.84	24.16	27.88	25.41	91.02	19.90	0.00	
OXON-101-R-2001	22.20	20.46	24.42	30.30	25.80	83.74	23.64	0.00	
OXON-205-R-2001									
PAXM-101-R-2001	19.45	18.62	20.24	24.53	22.66	43.76	0.33	0.00	
PAXM-106-R-2001	20.54	19.47	21.66	25.44	23.54	65.83	2.84	0.00	
PAXM-107-R-2001	18.38	17.14	20.45	27.53	21.18	15.40	0.53	0.00	
PAXM-109-R-2001									
PAXM-112-R-2001									
PAXM-114-R-2001	19.26	18.40	20.19	24.52	22.48	38.62	0.45	0.00	
PAXM-115-R-2001	19.20	17.97	20.45	24.57	22.37	38.41	0.41	0.00	
PAXM-119-R-2001	19.06	17.91	20.24	24.06	21.70	33.73	0.02	0.00	
PAXM-120-R-2001	20.55	18.41	23.05	28.79	24.89	61.50	9.04	0.00	
PAXM-121-R-2001	18.36	17.17	19.80	23.34	21.34	25.17	0.00	0.00	
PAXM-122-R-2001	19.60	18.45	20.98	24.56	22.68	48.01	0.77	0.00	
PAXM-211-R-2001									
PAXM-213-R-2001	20.49	19.06	22.51	32.33	23.82	67.05	4.92	0.02	
PISC-103-R-2001									
PISC-104-R-2001	20.00	18.91	21.14	26.13	22.69	55.19	0.60	0.00	
PISC-105-R-2001	20.32	19.23	21.95	26.76	22.96	61.48	0.95	0.00	
PISC-106-R-2001	20.55	19.07	22.14	25.63	23.56	67.31	3.43	0.00	
PISC-109-R-2001									
PISC-112-R-2001	21.70	19.73	24.19	27.49	25.39	77.58	17.97	0.00	
PISC-113-R-2001	21.49	20.66	22.58	28.47	24.41	81.26	7.38	0.00	
PISC-115-R-2001	18.21	17.49	19.15	24.41	20.71	12.54	0.03	0.00	
PISC-201-R-2001	20.13	19.41	21.03	27.48	23.66	53.92	3.28	0.00	
PISC-207-R-2001	22.58	21.40	23.89	27.14	25.73	91.02	26.35	0.00	
PRAL-103-R-2001									Stream was dry in the summer
PRAL-104-R-2001									Stream was dry in the summer
PRAL-106-R-2001									Stream was dry in the summer
PRAL-107-R-2001	18.21	16.16	20.39	27.99	22.62	25.29	2.36	0.00	
PRAL-208-R-2001	18.57	17.07	20.14	25.23	22.16	27.78	0.17	0.00	
PRUN-101-R-2001	15.22	13.75	16.78	31.94	17.59	0.56	0.45	0.00	
PRUN-102-R-2001	15.49	13.45	18.37	30.71	20.41	5.90	1.16	0.00	

Table C-1. (Continued)

Site	Mean Average Daily Temperature	Mean Minimum Daily Temperature	Mean Maximum Daily Temperature	Absolute Maximum	95th Percentile	Percent Exceedences 20 ˚C	Percent Exceedences 23.9 ˚C	Percent Exceedences 32 ˚C	Notes
PRUN-106-R-2001									
PRUN-107-R-2001	15.58	14.79	16.41	28.41	18.08	0.38	0.38	0.00	Temperature logger data from site 103 was used
PRUN-109-R-2001									
PRUN-205-R-2001	15.42	14.38	16.34	29.13	18.22	0.45	0.42	0.00	
PRUN-210-R-2001	15.42	14.38	16.34	29.13	18.22	0.45	0.42	0.00	Temperature logger data from site 205 is used
PRUN-211-R-2001	15.92	14.40	17.92	27.78	18.98	1.28	0.39	0.00	
PRUT-103-R-2001	18.71	17.57	20.25	26.16	21.22	21.94	0.33	0.00	
PRUT-106-R-2001	20.35	19.49	21.45	27.58	23.07	61.08	1.63	0.00	
PRUT-107-R-2001	21.14	19.51	23.12	27.55	24.58	71.84	8.68	0.00	
PRUT-108-R-2001	21.53	20.60	22.54	26.75	24.32	81.37	8.26	0.00	
PRUT-114-R-2001	20.77	18.80	23.69	29.81	24.99	60.88	11.94	0.00	
PRUT-116-R-2001	19.64	18.88	20.45	23.68	22.00	48.60	0.00	0.00	
PRUT-117-R-2001	23.59	21.91	25.58	33.11	28.37	93.08	44.75	0.32	
PRUT-202-R-2001	23.49	21.01	27.25	33.43	28.54	89.90	41.16	0.60	
SASS-102-R-2001	23.41	20.59	27.07	30.79	28.39	88.04	43.35	0.00	
SASS-104-R-2001	19.35	18.49	20.28	22.81	21.31	33.72	0.00	0.00	
SASS-120-R-2001	20.34	19.60	21.16	23.89	22.38	69.05	0.00	0.00	
SASS-205-R-2001	22.03	20.03	24.24	28.38	25.54	80.67	20.35	0.00	
SENE-101-R-2001	18.60	17.05	21.36	27.76	21.71	24.32	0.62	0.00	
SENE-103-R-2001	18.33	16.82	20.33	23.92	21.23	19.04	0.03	0.00	
SENE-104-R-2001	19.01	18.38	19.67	23.68	22.17	34.52	0.00	0.00	
SENE-109-R-2001	18.22	17.43	19.12	23.16	20.67	12.06	0.00	0.00	
SENE-112-R-2001	20.64	19.15	22.41	30.51	24.62	62.18	7.66	0.00	
SENE-113-R-2001	18.93	18.23	19.82	24.03	21.67	28.63	0.06	0.00	
SENE-114-R-2001	18.64	17.64	19.58	24.48	21.44	19.98	0.15	0.00	
SENE-115-R-2001	14.39	13.81	15.07	20.81	16.32	0.14	0.00	0.00	
SENE-117-R-2001	19.35	17.68	21.10	24.74	22.69	42.52	0.94	0.00	
SENE-119-R-2001									Stream was dry in the summer
SENE-205-R-2001									
SENE-210-R-2001	21.38	19.79	23.25	28.21	25.03	73.23	13.42	0.00	Temperature logger data from site 211 is used
SENE-211-R-2001	21.38	19.79	23.25	28.21	25.03	73.23	13.42	0.00	
SENE-306-R-2001	20.05	18.12	22.06	26.88	23.59	51.96	4.18	0.00	
SENE-316-R-2001	12.79	11.46	14.52	19.51	16.79	0.00	0.00	0.00	
SIDE-101-R-2001									Stream was dry in the summer
SIDE-109-R-2001	17.47	16.15	19.34	27.78	20.92	10.33	0.06	0.00	
SIDE-402-R-2001	23.84	21.46	26.76	32.31	28.56	91.47	49.93	0.09	
SIDE-405-R-2001	22.41	20.56	24.28	28.92	26.41	82.74	27.81	0.00	
SIDE-410-R-2001	22.41	20.56	24.28	28.92	26.41	82.74	27.81	0.00	Temperature logger data from site 405 was used

Table C-1. (Continued)

Site	Mean Average Daily Temperature	Mean Minimum Daily Temperature	Mean Maximum Daily Temperature	Absolute Maximum	95th Percentile	Percent Exceedences 20 ˚C	Percent Exceedences 23.9 ˚C	Percent Exceedences 32 ˚C	Notes
STIL-114-R-2001	20.65	20.00	21.43	25.34	23.28	69.68	2.22	0.00	
STIL-119-R-2001	20.28	18.98	21.93	26.79	23.50	61.65	3.77	0.00	
STIL-207-R-2001	20.14	19.17	21.20	24.56	22.68	58.67	1.06	0.00	
UPPC-101-R-2001									Stream was dry in the summer
UPPC-103-R-2001	22.89	20.83	25.11	28.93	26.78	89.79	29.14	0.00	
UPPC-105-R-2001	21.22	19.98	22.41	25.86	24.13	72.13	6.72	0.00	
UPPC-106-R-2001									
UPPC-107-R-2001	23.75	21.37	26.45	31.33	28.18	91.29	48.07	0.00	
UPPC-113-R-2001	21.22	19.98	22.41	25.86	24.13	72.13	6.72	0.00	Temperature logger data from site 105 was used
UPPC-114-R-2001	23.75	21.37	26.45	31.33	28.18	91.29	48.07	0.00	Temperature logger data from site 107 was used
UPPC-115-R-2001									
UPPC-117-R-2001	21.68	20.64	22.64	26.70	24.61	79.93	10.77	0.00	
UPPC-118-R-2001	22.89	20.83	25.11	28.93	26.78	89.79	29.14	0.00	Temperature logger data from site 103 was used
UPPC-204-R-2001	21.48	20.57	22.45	25.59	24.37	80.52	7.78	0.00	
UPPC-216-R-2001	21.48	20.57	22.45	25.59	24.37	80.52	7.78	0.00	Temperature logger data from site 204 was used
UPPC-410-R-2001									No temperature logger deployed
WEBR-104-R-2001	24.51	22.91	26.39	29.68	27.84	94.85	65.03	0.00	
WEBR-105-R-2001	20.11	19.15	21.01	24.54	23.01	60.08	0.77	0.00	
WEBR-106-R-2001	21.59	20.30	22.94	28.98	25.93	75.57	18.19	0.00	
WEBR-107-R-2001									
WEBR-110-R-2001	20.31	18.91	21.73	26.20	23.44	61.14	2.93	0.00	
WEBR-111-R-2001	20.11	19.15	21.01	24.54	23.01	60.08	0.77	0.00	Temperature logger data from site 105 used
WEBR-113-R-2001	20.60	19.35	22.05	28.22	23.83	65.80	4.48	0.00	
WEBR-116-R-2001	19.62	18.51	20.68	24.13	22.11	46.53	0.03	0.00	
WEBR-201-R-2001									
WEBR-212-R-2001	22.09	21.03	23.15	27.61	25.14	85.94	18.07	0.00	
YOUG-101-R-2001	16.84	15.07	18.87	23.64	20.81	8.53	0.00	0.00	
YOUG-102-R-2001	18.34	15.56	22.71	32.26	22.91	24.70	2.81	0.03	
YOUG-106-R-2001	15.73	14.62	16.80	20.32	18.86	0.20	0.00	0.00	
YOUG-107-R-2001	15.00	13.39	16.77	29.89	19.39	3.25	0.60	0.00	
YOUG-110-R-2001									
YOUG-112-R-2001									
YOUG-117-R-2001	17.06	15.51	18.57	33.72	21.67	13.63	2.51	0.26	
YOUG-118-R-2001	14.45	13.93	15.01	17.49	16.69	0.00	0.00	0.00	
YOUG-123-R-2001	16.33	14.99	17.77	22.68	19.56	3.10	0.00	0.00	
YOUG-127-R-2001	15.73	14.62	16.80	20.32	18.86	0.20	0.00	0.00	Temperature logger data from site 107 used
YOUG-208-R-2001	16.80	15.43	18.14	21.61	19.81	3.59	0.00	0.00	
YOUG-214-R-2001	18.36	16.46	20.58	30.09	22.36	25.64	1.56	0.00	

Table C-1. (Continued)

Site	Mean Average Daily Temperature	Mean Minimum Daily Temperature	Mean Maximum Daily Temperature	Absolute Maximum	95th Percentile	Percent Exceedences 20 ˚C	Percent Exceedences 23.9 ˚C	Percent Exceedences 32 ˚C	Notes
YOUG-231-R-2001	16.73	14.74	19.39	26.02	21.59	10.87	1.42	0.00	
YOUG-320-R-2001	19.54	17.77	21.43	25.47	23.41	45.46	3.53	0.00	
ZEKI-103-R-2001	18.22	17.63	18.84	22.09	20.77	17.08	0.00	0.00	
ZEKI-104-R-2001	20.05	18.51	21.77	25.83	23.25	55.34	1.89	0.00	
ZEKI-106-R-2001	21.53	20.02	23.14	26.36	24.27	81.07	8.97	0.00	
ZEKI-109-R-2001									
ZEKI-116-R-2001	18.78	17.74	19.86	23.84	21.33	28.88	0.00	0.00	
ZEKI-117-R-2001	24.67	23.75	25.74	31.12	28.15	97.60	68.05	0.00	
ZEKI-118-R-2001									
ZEKI-215-R-2001	20.20	19.18	21.28	25.49	23.08	59.32	1.72	0.00	
ZEKI-302-R-2001	21.75	20.06	23.75	32.77	25.62	77.99	16.43	0.06	
ZEKI-305-R-2001	21.52	19.21	23.89	29.39	25.98	74.18	18.06	0.00	
ZEKI-307-R-2001	21.01	20.01	21.88	25.85	23.95	74.15	5.77	0.00	
ZEKI-312-R-2001	21.76	20.49	23.09	27.36	24.91	80.57	13.54	0.00	

APPENDIX D

SENTINEL SITE DATA

Table D-1. Sentinel sites sampled by MBSS in 2000. Round One data are shown.

SITE	SITENEW	STREAM NAME	COUNTY	ORDER	STRATA_R	PH_ LAB	NO3_ LAB	SO4_ LAB	DOC_ LAB	ACID SOURCE	PERCENT FOREST	FIBI	BIBI	CBI	BKTRFLAG	BLACKWAT
WO-S-038-108-97	NASS-108-S-1997	MILLVILLE CREEK	WORCESTER	1	COASTAL-E	4.4	0.35	3.99	32.9	ORG	83.23	3.25	1.29	2.27	0	1
KE-N-096-102-95	LOCR-102-S-1995	SWAN CREEK	KENT	1	COASTAL-E	5.86	0.12	17.46	20	ORG & AD	70.33	2.75	1.86	1.86	0	1
CN-N-024-113-96	UPCK-113-S-1996	SKELETON CREEK	CAROLINE	1	COASTAL-E	5.95	0.6	15.9	15.9	ORG & AD	61.01	2.75	2.14	2.14	0	1
WI-S-063-220-95	WIRH-220-S-1995	LEONARD POND RUN	WICOMICO	2	COASTAL-E	6.64	2.08	5.28	6	none	56.48	3.25	3	3.12	0	0
QA-N-086-118-95	WYER-118-S-1995	UT WYE EAST RIVER	QUEEN ANNES	1	COASTAL-E	6.8	1.16	13.26	22	none	57.09	3	3.86	3.43	0	0
NEVER SAMPLED	NASS-301-S-2000	NASSAWANGO CREEK	WICOMICO	3	COASTAL-E											
CH-S-033-314-95	MATT-033-S-1995	MATTAWOMAN CREEK	CHARLES	3	COASTAL-W	6.6	0.24	12.84	4	AD	69.63	3.5	2.71	3.10	0	0
CH-S-331-304-95	NANJ-331-S-1995	MILL RUN	CHARLES	3	COASTAL-W	6.46	0.33	11.61	3	AD	81.14	4.75	3.86	4.30	0	0
CH-S-012-114-95	ZEKI-012-S-1995	UT ZEKIAH SWAMP RUN	CHARLES	1	COASTAL-W	6.2	0.34	14.82	3	AD	95.19	3.75	4.43	4.09	0	0
CH-S-294-236-97	PAXL-294-S-1997	SWANSON CREEK	CHARLES	2	COASTAL-W	6.85	0.6	14.76	2.5	AD	69.33	4.25	3.57	3.91	0	0
SM-S-051-132-95	STCL-051-S-1995	UT ST CLEMENTS CREEK	ST. MARYS	1	COASTAL-W	6.86	0.2	7.05	4	none	79.26		3.86	3.86	0	0
CA-S-086-209-97	WCHE-086-S-1997	PLUM POINT CREEK	CALVERT	2	COASTAL-W	7.36	0	16.21	3.2	none	74.93	2.75	3.29	3.02	0	0
CH-S-002-207-95	PTOB-002-S-1995	HOGHOLE RUN	CHARLES	2	COASTAL-W	6.62	0.2	10.51	3	AD	83.58	4.5	3.29	3.90	0	0
BA-P-025-102-96	LOCH-102-S-1996	BEAVERDAM RUN	BALTIMORE	1	EPIEDMNT	6.37	1.53	4.81	4.9	AD	56.69	3.44	3.22	3.33	1	0
BA-P-077-322-95	JONE-322-S-1995	NORTH BRANCH	BALTIMORE	3	EPIEDMNT	7.65	1.37	4.77	2	none	52.69	2.56	3.44	3.00	0	0
BA-P-077-315-96	JONE-315-S-1996	NORTH BRANCH	BALTIMORE	3	EPIEDMNT	7.6	1.32	7.36	2.6	none	56.62	3	3.67	3.34	0	0
BA-P-234-109-95	JONE-109-S-1995	DIPPING POND RUN	BALTIMORE	1	EPIEDMNT	6.77	2.51	2.09	1	none	74.33		3.67	3.67	1	0
HO-P-228-119-97	RKGR-119-S-1997	UN TRIB TO PATUXENT RIVER	HOWARD	1	EPIEDMNT	7.69	1.36	7.17	1.5	none	65.92	3.44	4.11	3.78	0	0
BA-P-057-209-96	LOCH-209-S-1996	GREENE BRANCH	BALTIMORE	2	EPIEDMNT	7.43	2.3	9.72	1.4	none	56.58	2.78	3.44	3.11	0	0
BA-P-015-120-96	LOCH-120-S-1996	BAISMANS RUN	BALTIMORE	1	EPIEDMNT	6.97	2.55	3.99	1.1	AD	58.59	1.89	4.33	4.33	1	0
GA-A-159-202-96	SAVA-159-S-1996	MIDDLE FORK	GARRETT	2	HIGHLAND	6.83	0.72	14.05	1	AD	90.35	4.14	3.44	3.79	1	0
GA-A-999-302-96	SAVA-225-S-1996	SAVAGE RIVER	GARRETT	3	HIGHLAND	7.07	0.8	12.03	1.5	AD	83.46	4.14	4.33	4.23	1	0
FR-P-288-133-96	UMON-288-S-1996	TRIB TO HUNTING CREEK	FREDERICK	1	HIGHLAND	7.33	0.56	6.49	1.7	none	88.62	4.14	3.22	3.68	0	0
AL-A-626-216-96	PRLN-626-S-1996	MILL RUN	ALLEGANY	2	HIGHLAND	7.51	0.68	12.89	1.1	none	100.6	2.71	3.67	3.67	1	0
GA-A-432-315-95	YOUG-432-S-1995	BEAR CREEK	GARRETT	3	HIGHLAND	6.96	0.65	9.59	1	AD	76.12	4.14	4.11	4.12	1	0
GA-A-276-106-96	SAVA-276-S-1996	DOUBLE LICK RUN	GARRETT	1	HIGHLAND	6.77	0.49	12.89	0.8	AD	92.12	4.71	3.67	4.19	1	0
AL-A-207-307-95	FIMI-207-S-1995	FIFTEENMILE CREEK	ALLEGANY	3	HIGHLAND	6.91	0.26	10.34	2	AD	89.73	2.71	4.11	3.41	0	0

Table D-2. Sites sampled in 2000 that met sentinel site screening criteria. MBSS 2000 data are shown.

SITE	SITE TYPE	STREAM NAME	COUNTY	ORDER	STRATA_R	PH_ LAB	NO3_ LAB	SO4_ LAB	DOC_ LAB	ACID SOURCE	PERCENT FOREST	FIBI	BIBI	CBI	BRKTROUT	BLACKWAT
LOCR-102-S-2000	SENTINEL	SWAN CREEK	KENT	1	COASTAL-E	6.02	0.085	4.943	33.182	ORG	85.19	2.75	1.29	1.29	0	1
WIRH-220-S-2000	SENTINEL	LEONARD POND RUN	WICOMICO	2	COASTAL-E	6.23	0.548	1.734	16.032	NONE	51.41	3.25	3.57	3.41	0	1
NASS-108-S-2000	SENTINEL	MILLVILLE CREEK	WORCESTER	1	COASTAL-E	4.41	0.082	3.405	36.061	ORG	77.82	2.00	1.00	1.00	0	1
UPCK-113-S-2000	SENTINEL	SKELETON CREEK	CAROLINE	1	COASTAL-E	5.53	0.117	6.413	28.632	NONE	61.01	2.25	2.71	2.71	0	1
UPCK-115-R-2000		TIDY ISLAND CREEK	CAROLINE	1	COASTAL-E	6.51	0.515	9.530	9.478	ORG	67.55	3.25	1.57	2.41	0	1
UPCK-311-R-2000		FORGE BRANCH	CAROLINE	3	COASTAL-E	6.52	2.851	14.234	7.015	NONE	63.21	4.00	3.29	3.64	0	0
CORS-102-R-2000		KIRBY CREEK	QUEEN ANNES	1	COASTAL-E	6.35	0.164	5.435	17.384	NONE	89.92	1.75	3.29	3.29	0	1
MONI-126-R-2000		MONIE CREEK	SOMERSET	1	COASTAL-E	4.42	0.000	1.594	41.757	AD	92.58	1.75	1.00	1.00	0	1
LOWI-113-R-2000		BEAVERDAM CREEK	WICOMICO	1	COASTAL-E	5.63	0.919	9.971	16.018	ORG	57.25	1.75	1.00	1.00	0	1
WIRH-109-R-2000		LEONARD POND RUN	WICOMICO	1	COASTAL-E	4.31	0.263	5.568	28.823	NONE	93.78	1.00	1.00	1.00	0	1
WIRH-111-R-2000		LEONARD POND RUN	WICOMICO	1	COASTAL-E	5.29	0.931	6.277	18.544	ORG	86.73	2.75	1.29	1.29	0	1
WIRH-114-R-2000		MORRIS BRANCH	WICOMICO	1	COASTAL-E	4.42	0.993	14.345	18.600	ORG	59.23		1.86	1.86	0	1
MATT-033-S-2000	SENTINEL	MATTAWOMAN CREEK	CHARLES	3	COASTAL-W	6.73	0.137	9.472	6.957	NONE	70.03	3.50	3.86	3.68	0	0
NANJ-331-S-2000	SENTINEL	MILL RUN	CHARLES	3	COASTAL-W	6.47	0.164	10.634	3.087	ORG	81.25	3.00	3.57	3.28	0	0
PAXL-294-S-2000	SENTINEL	SWANSON CREEK	CHARLES	2	COASTAL-W	6.70	0.313	14.736	3.106	ORG	69.71	3.00	3.86	3.43	0	0
PTOB-002-S-2000	SENTINEL	HOGHOLE RUN	CHARLES	2	COASTAL-W	6.46	0.000	9.926	3.446	NONE	83.55	4.25	3.57	3.91	0	0
ZEKI-012-S-2000	SENTINEL	ZEKIAH SWAMP RUN	CHARLES	1	COASTAL-W	6.52	0.079	7.876	2.566	AD	92.95	3.25	4.14	3.70	0	0
STCL-051-S-2000	SENTINEL	ST CLEMENS CREEK	ST. MARYS	1	COASTAL-W	7.03	0.000	6.053	3.436	NONE	74.93		3.57	3.57	0	0
MATT-210-R-2000		PINEY BRANCH	CHARLES	2	COASTAL-W	6.58	0.259	11.241	3.240	NONE	62.35	3.50	4.14	3.82	0	0
MATT-212-R-2000		MATTAWOMAN CREEK	CHARLES	2	COASTAL-W	7.03	0.188	8.856	2.325	AD	72.47	4.25	4.71	4.48	0	0
MATT-216-R-2000		PINEY BRANCH	CHARLES	2	COASTAL-W	6.35	0.271	11.010	4.679	ORG	61.92	4.25	4.43	4.34	0	0
NANJ-115-R-2000		HILL TOP FORK	CHARLES	1	COASTAL-W	6.09	0.036	3.465	2.811	AD	77.52	3.75	3.00	3.38	0	0
NANJ-205-R-2000		HANCOCK RUN	CHARLES	2	COASTAL-W	5.71	0.000	5.105	10.288	ORG	82.10	1.25	1.86	1.86	0	1
NANJ-308-R-2000		NANJEMOY CREEK	CHARLES	3	COASTAL-W	6.31	0.000	5.094	14.126	AD	87.57	3.50	2.71	3.10	0	1
MATT-320-R-2000		MATTAWOMAN CREEK	CHARLES/ PRINCE GEORGES	3	COASTAL-W	6.60	0.082	8.217	9.655	AD	63.51	3.00	3.57	3.57	0	1
ABPG-108-R-2000		MOSQUITO CREEK	HARFORD	1	COASTAL-W	5.41	0.019	8.964	17.905	ORG	67.59		1.29	1.29	0	1
STMA-104-R-2000		WAREHOUSE RUN	ST. MARYS	1	COASTAL-W	6.76	0.452	10.834	4.242	NONE	81.77	4.75	4.43	4.59	0	0
STMA-110-R-2000		BROOM CREEK	ST. MARYS	1	COASTAL-W	6.32	0.528	10.397	2.314	AD	75.85		4.14	4.14	0	0
STMA-113-R-2000		ST MARY'S RIVER	ST. MARYS	1	COASTAL-W	6.15	0.326	14.553	3.457	NONE	65.97	4.00	3.29	3.64	0	0
STMA-116-R-2000		ST GEORGE CREEK	ST. MARYS	1	COASTAL-W	4.80	0.000	12.645	33.384	AD	76.63		1.00	1.00	0	1
STMA-202-R-2000		ST MARY'S RIVER	ST. MARYS	2	COASTAL-W	6.23	0.217	5.040	8.928	ORG	73.03	3.50	2.43	2.96	0	1
STMA-306-R-2000		ST MARY'S RIVER	ST. MARYS	3	COASTAL-W	6.45	0.306	6.239	5.887	ORG	69.39	3.25	3.86	3.56	0	0
JONE-109-S-2000	SENTINEL	DIPPING POND RUN	BALTIMORE	1	EPIEDMNT	6.41	2.386	2.660	0.792	NONE	76.78		4.11	4.11	0	0
JONE-315-S-2000	SENTINEL	NORTH BR JONES FALLS	BALTIMORE	3	EPIEDMNT	7.52	1.066	6.174	2.007	NONE	56.29	3.22	4.33	3.78	0	0
JONE-322-S-2000	SENTINEL	NORTH BR JONES FALLS	BALTIMORE	3	EPIEDMNT	7.53	0.931	6.745	2.000	NONE	52.35	2.78	4.33	3.56	0	0
LOCH-102-S-2000	SENTINEL	BEAVERDAM RUN	BALTIMORE	1	EPIEDMNT	6.32	2.326	2.360	1.779	AD	56.60	3.00	4.33	4.33	1	0
LOCH-120-S-2000	SENTINEL	BAISMAN RUN	BALTIMORE	1	EPIEDMNT	7.01	1.075	4.918	0.988	AD	62.99	2.78	3.22	3.22	1	0
LOCH-209-S-2000	SENTINEL	GREENE BRANCH	BALTIMORE	2	EPIEDMNT	7.54	1.745	10.518	1.229	NONE	53.91	3.22	3.67	3.44	0	0
RKGR-119-S-2000	SENTINEL	PATUXENT RIVER	HOWARD	1	EPIEDMNT	7.49	1.205	7.586	1.564	AD	66.76	3.89	3.44	3.66	0	0
LIBE-101-C-2000		TIMBER RUN	BALTIMORE	1	EPIEDMNT	7.03	1.049	5.407	1.129	NONE	77.51	3.89	5.00	4.44	1	0
LIBE-102-C-2000		TIMBER RUN	BALTIMORE	1	EPIEDMNT	6.97	1.126	4.826	0.935	NONE	76.96	4.33	4.11	4.22	1	0
LIBE-103-C-2000		COOKS BRANCH	BALTIMORE	1	EPIEDMNT	7.43	1.052	8.377	1.443	NONE	73.15	3.89	4.33	4.11	1	0
LIBE-117-R-2000		LIBERTY RESERVOIR	BALTIMORE	1	EPIEDMNT	6.85	1.049	7.573	1.535	NONE	71.52	3.00	4.11	3.56	0	0
LIBE-204-C-2000		COOKS BRANCH	BALTIMORE	2	EPIEDMNT	7.39	1.003	7.917	1.116	NONE	74.31	3.89	4.56	4.22	1	0
LIBE-203-R-2000		MORGAN RUN	CARROLL	2	EPIEDMNT	7.41	3.749	5.832	1.304	NONE	95.38	4.11	3.44	3.78	0	0
SBPA-329-R-2000		GILLIS FALLS	CARROLL	3	EPIEDMNT	7.56	3.279	4.778	1.317	NONE	76.57	4.11	4.11	4.11	0	0
FURN-101-C-2000		WINCH RUN (BUCK SWAMP CREEK)	CECIL	1	EPIEDMNT	6.66	0.509	4.055	2.224	ORG	86.36	3.89	4.56	4.22	0	0

Table D-2. (Continued)

SITE	SITE TYPE	STREAM NAME	COUNTY	ORDER	STRATA_R	PH_ LAB	NO3_ LAB	SO4_ LAB	DOC_ LAB	ACID SOURCE	PERCENT FOREST	FIBI	BIBI	CBI	BRKTROUT	BLACKWAT
SWAN-104-R-2000		CARSINS RUN	HARFORD	1	EPIEDMNT	7.39	0.439	6.668	6.159	AD	61.11	3.67	4.11	3.89	0	0
SWAN-105-R-2000		CARSINS RUN	HARFORD	1	EPIEDMNT	7.42	0.582	9.060	4.241	NONE	64.92	3.67	4.11	3.89	0	0
BRIG-212-R-2000		CABIN BRANCH	HOWARD	2	EPIEDMNT	7.08	2.895	4.721	1.678	NONE	61.26	3.22	3.89	3.56	0	0
PATL-222-R-2000		DEEP RUN	HOWARD	2	EPIEDMNT	7.73	0.265	23.172	2.410	NONE	50.65	4.11	3.67	3.89	0	0
FIMI-207-S-2000	SENTINEL	FIFTEENMILE CREEK	ALLEGANY	2	HIGHLAND	7.09	0.196	9.015	2.211	AD	89.69	3.29	3.44	3.36	0	0
PRLN-626-S-2000	SENTINEL	MILL RUN	ALLEGANY	2	HIGHLAND	7.56	0.443	13.174	0.987	NONE	100.00	3.57	4.56	4.07	1	0
UMON-288-S-2000	SENTINEL	HIGH RUN	FREDERICK	2	HIGHLAND	6.52	0.163	3.653	1.603	NONE	81.63	2.43	4.33	4.33	1	0
SAVA-159-S-2000	SENTINEL	MIDDLE FORK RUN	GARRETT	1	HIGHLAND	7.03	0.425	13.162	0.789	AD	90.21	4.43	4.33	4.38	1	0
SAVA-225-S-2000	SENTINEL	SAVAGE RIVER	GARRETT	2	HIGHLAND	7.26	0.452	11.607	2.449	NONE	83.87	3.57	4.78	4.18	1	0
SAVA-276-S-2000	SENTINEL	DOUBLE LICK RUN	GARRETT	2	HIGHLAND	6.75	0.329	12.110	0.700	AD	92.64	4.14	4.33	4.24	1	0
YOUG-432-S-2000	SENTINEL	BEAR CREEK	GARRETT	4	HIGHLAND	7.01	0.788	9.773	2.329	AD	76.25	3.86	4.78	4.32	1	0
FIMI-103-R-2000		FIFTEENMILE CREEK	ALLEGANY	1	HIGHLAND	6.48	0.095	7.828	1.713	AD	100.00		3.44	3.44	0	0
FIMI-105-R-2000		SIDELING HILL CREEK	ALLEGANY	1	HIGHLAND	6.58	0.145	11.058	1.273	AD	77.19		4.11	4.11	0	0
FIMI-108-R-2000		FIFTEENMILE CREEK	ALLEGANY	1	HIGHLAND	6.91	0.348	7.919	1.769	AD	70.83		3.67	3.67	0	0
FIMI-202-R-2000		BLACK SULFER RUN	ALLEGANY	2	HIGHLAND	7.03	0.259	9.994	1.300	AD	97.12	3.29	3.89	3.59	0	0
FIMI-401-R-2000		FIFTEENMILE CREEK	ALLEGANY	4	HIGHLAND	7.15	0.233	11.613	1.473	NONE	92.27	4.71	4.11	4.41	0	0
FIMI-404-R-2000		FIFTEENMILE CREEK	ALLEGANY	4	HIGHLAND	7.29	0.118	11.672	1.319	NONE	92.85	4.43	2.56	3.50	0	0
FIMI-407-R-2000		FIFTEENMILE CREEK	ALLEGANY	4	HIGHLAND	7.40	0.122	11.725	1.331	AD	92.80	4.71	3.44	4.08	0	0
TOWN-104-R-2000		SAWPIT RUN	ALLEGANY	1	HIGHLAND	6.68	0.000	12.234	2.050	NONE	100.00		3.44	3.44	0	0
TOWN-408-R-2000		TOWN CREEK	ALLEGANY	4	HIGHLAND	7.54	0.219	12.094	1.693	AD	82.58	3.29	4.33	3.81	0	0
TOWN-409-R-2000		TOWN CREEK	ALLEGANY	4	HIGHLAND	7.64	0.296	14.091	1.771	NONE	81.85	4.43	4.78	4.61	0	0
TOWN-412-R-2000		TOWN CREEK	ALLEGANY	4	HIGHLAND	7.86	0.303	14.024	1.766	NONE	81.87	5.00	4.33	4.66	0	0
WILL-102-C-2000		HAZEN RUN	ALLEGANY	1	HIGHLAND	7.94	0.549	14.184	1.598	ORG	98.59	4.43	3.22	3.82	1	0
LMON-136-T-2000		UT LAUREL BRANCH	FREDERICK	1	HIGHLAND	6.93	0.445	10.025	1.478	NONE	57.74		3.22	3.22	0	0
UMON-101-C-2000		LITTLE FISHING CREEK	FREDERICK	1	HIGHLAND	6.70	0.106	1.554	0.841	NONE	99.86	4.43	3.67	4.05	1	0
UMON-119-R-2000		BUZZARD BRANCH	FREDERICK	1	HIGHLAND	7.05	0.139	5.757	1.841	NONE	99.33	2.71	3.67	3.67	1	0
UMON-207-R-2000		LITTLE HUNTING CREEK	FREDERICK	2	HIGHLAND	6.98	0.225	6.246	1.220	AD	75.73	3.86	3.00	3.43	0	0
UMON-221-R-2000		HUNTING CREEK	FREDERICK	2	HIGHLAND	7.42	0.462	7.761	5.658	NONE	80.54	3.86	4.33	4.10	0	0
UMON-229-R-2000		MUDDY RUN	FREDERICK	2	HIGHLAND	7.23	0.309	4.553	1.715	NONE	94.11	3.86	3.00	3.43	0	0
UMON-230-R-2000		HUNTING CREEK	FREDERICK	2	HIGHLAND	7.23	0.411	7.500	2.170	NONE	89.66	3.57	4.33	3.95	0	0
UMON-304-R-2000		FRIENDS CREEK	FREDERICK	3	HIGHLAND	7.75	0.701	13.875	2.199	AD	69.89	4.43	4.11	4.27	0	0
UMON-322-R-2000		HUNTING CREEK	FREDERICK	3	HIGHLAND	7.61	0.455	7.555	2.484	NONE	82.69	4.14	4.11	4.12	0	0
UMON-413-R-2000		TOMS CREEK	FREDERICK	4	HIGHLAND	7.74	0.657	12.358	2.547	NONE	77.24	3.57	3.22	3.40	0	0
CASS-104-R-2000		SOUTH BR CASSELMAN RIVER	GARRETT	1	HIGHLAND	7.02	0.488	22.479	1.402	NONE	78.28	3.86	4.78	4.32	1	0
CASS-110-R-2000		TWOMILE RUN	GARRETT	1	HIGHLAND	7.41	1.562	17.228	1.378	AD	54.96	4.43	3.67	4.05	1	0
CASS-307-R-2000		CASSELMAN RIVER	GARRETT	3	HIGHLAND	6.93	0.400	19.929	1.463	AD	78.80	3.57	4.78	4.18	0	0
LYOU-101-C-2000		BLACK RUN	GARRETT	1	HIGHLAND	7.03	0.267	8.418	7.030	NONE	96.31	4.43	4.78	4.61	1	0
SAVA-101-C-2000		MONROE RUN	GARRETT	1	HIGHLAND	7.20	0.281	12.337	1.066	NONE	96.12	4.14	4.78	4.46	1	0
SAVA-203-C-2000		POPLAR LICK RUN	GARRETT	2	HIGHLAND	7.14	0.324	10.617	1.152	AD	93.62	4.14	4.78	4.46	1	0
SAVA-204-C-2000		CRABTREE CREEK	GARRETT	2	HIGHLAND	7.55	0.392	13.202	0.905	AD	87.35	5.00	5.00	5.00	1	0
YOUG-202-C-2000		POPLAR LICK RUN	GARRETT	2	HIGHLAND	7.50	0.405	10.539	1.052	AD	92.03	4.43	3.89	4.16	1	0
YOUG-203-C-2000		PUZZLEY RUN	GARRETT	2	HIGHLAND	7.21	0.805	13.966	0.906	NONE	72.50	4.14	4.78	4.46	1	0
ANTI-101-C-2000		EDGEMONT RESERVOIR	WASHINGTON	1	HIGHLAND	7.54	0.463	10.654	1.760	NONE	87.71	2.14	3.67	3.67	1	0
LTON-108-R-2000		LITTLE TONOLOWAY CREEK	WASHINGTON	1	HIGHLAND	8.11	0.483	19.937	2.735	NONE	60.12	3.00	3.22	3.11	0	0
LTON-113-R-2000		LITTLE TONOLOWAY CREEK	WASHINGTON	1	HIGHLAND	8.28	0.351	21.501	2.358	AD	54.74	3.00	3.22	3.11	0	0

Table D-3. Sentinel sites sampled in MBSS 2001. MBSS 2000 data are shown.

SITE	SAMPLED	STREAM NAME	ORDER	STRATA_R	PH_LAB	NO3_ LAB	SO4_ LAB	DOC_L AB	ACIDSRC	PERCENT FOREST	FIBI	BIBI	CBI	BKTRFLAG	BLACKWAT
LOCR-102-S-2000	2000	SWAN CREEK	1	COASTAL-E	6.02	0.085	4.943	33.182	ORG	85.19	2.75	1.29	1.29	0	1
NASS-108-S-2000	2000	MILLVILLE CREEK	1	COASTAL-E	4.41	0.082	3.405	36.061	ORG	77.82	2.00	1.00	1.00	0	1
UPCK-113-S-2000	2000	SKELETON CREEK	1	COASTAL-E	5.53	0.117	6.413	28.632	NONE	61.01	2.25	2.71	2.71	0	1
WIRH-220-S-2000	2000	LEONARD POND RUN	2	COASTAL-E	6.23	0.548	1.734	16.032	NONE	51.41	3.25	3.57	3.41	0	1
CORS-102-R-2000	2000	KIRBY CREEK	1	COASTAL-E	6.35	0.164	5.435	17.384	NONE	89.92	1.75	3.29	3.29	0	1
NASS-302-S-2001		NASSAWANGO CREEK	3	COASTAL-E											
MATT-033-S-2000	2000	MATTAWOMAN CREEK	3	COASTAL-W	6.73	0.137	9.472	6.957	NONE	70.03	3.50	3.86	3.68	0	0
NANJ-331-S-2000	2000	MILL RUN	3	COASTAL-W	6.47	0.164	10.634	3.087	ORG	81.25	3.00	3.57	3.28	0	0
PAXL-294-S-2000	2000	SWANSON CREEK	2	COASTAL-W	6.70	0.313	14.736	3.106	ORG	69.71	3.00	3.86	3.43	0	0
PTOB-002-S-2000	2000	HOGHOLE RUN	2	COASTAL-W	6.46	0.000	9.926	3.446	NONE	83.55	4.25	3.57	3.91	0	0
STCL-051-S-2000	2000	UT ST CLEMENTS CREEK	1	COASTAL-W	7.03	0.000	6.053	3.436	NONE	74.93		3.57	3.57	0	0
WCHE-086-S-2000	2000	PLUM POINT CREEK	2	COASTAL-W	7.07	0.061	14.256	5.199	NONE	74.61	2.00	2.14	2.07	0	0
ZEKI-012-S-2000	2000	UT ZEKIAH SWAMP RUN	1	COASTAL-W	6.52	0.079	7.876	2.566	AD	92.95	3.25	4.14	3.70	0	0
JONE-109-S-2000	2000	DIPPING POND RUN	1	EPIEDMNT	6.41	2.386	2.660	0.792	NONE	76.78		4.11	4.11	0	0
JONE-315-S-2000	2000	NORTH BR JONES FALLS	3	EPIEDMNT	7.52	1.066	6.174	2.007	NONE	56.29	3.22	4.33	3.78	0	0
LOCH-120-S-2000	2000	BAISMANS RUN	1	EPIEDMNT	7.01	1.075	4.918	0.988	AD	62.99	2.78	3.22	3.22	1	0
RKGR-119-S-2000	2000	UN TRIB TO PATUXENT R	1	EPIEDMNT	7.49	1.205	7.586	1.564	AD	66.76	3.89	3.44	3.66	0	0
FURN-101-C-2000	2000	WINCH RUN (BUCK SWAMP CREEK)	1	EPIEDMNT	6.66	0.509	4.055	2.224	ORG	86.36	3.89	4.56	4.22	0	0
LIBE-102-C-2000	2000	TIMBER RUN	1	EPIEDMNT	6.97	1.126	4.826	0.935	NONE	76.96	4.33	4.11	4.22	1	0
FIMI-207-S-2000	2000	FIFTEENMILE CREEK	3	HIGHLAND	7.09	0.196	9.015	2.211	AD	89.69	3.29	3.44	3.36	0	0
PRLN-626-S-2000	2000	MILL RUN	2	HIGHLAND	7.56	0.443	13.174	0.987	NONE	100.00	3.57	4.56	4.07	1	0
SAVA-159-S-2000	2000	MIDDLE FORK RUN	2	HIGHLAND	7.03	0.425	13.162	0.789	AD	90.21	4.43	4.33	4.38	1	0
SAVA-225-S-2000	2000	SAVAGE RIVER	3	HIGHLAND	7.26	0.452	11.607	2.449	NONE	83.87	3.57	4.78	4.18	1	0
SAVA-276-S-2000	2000	DOUBLE LICK RUN	1	HIGHLAND	6.75	0.329	12.110	0.700	AD	92.64	4.14	4.33	4.24	1	0
UMON-288-S-2000	2000	TRIB TO HUNTING CREEK	1	HIGHLAND	6.52	0.163	3.653	1.603	NONE	81.63	2.43	4.33	4.33	1	0
YOUG-432-S-2000	2000	BEAR CREEK	3	HIGHLAND	7.01	0.788	9.773	2.329	AD	76.25	3.86	4.78	4.32	1	0

Table D-4. Sites sampled in 2001 that met Sentinel site screening criteria. MBSS 2001 data are shown.

SITE	SITE TYPE	STREAM NAME	COUNTY	ORDER	STRATA_R	PH_ LAB	NO3_ LAB	SO4_ LAB	DOC_ LAB	ACID SOURCE	PERCENT FOREST	FIBI	BIBI	CBI	BRKTROUT	BLACKWAT
CORS-102-S-2001	SENTINEL	UT EMORY CR	QUEEN ANNES	1	COASTAL-E	6.56	0.440	8.241	8.682	ORG & AD	89.92	1.75	2.71	2.71	0	1
LOCR-102-S-2001	SENTINEL	SWAN CR	KENT	1	COASTAL-E	5.92	0.169	7.821	20.150		85.19	2.75	1.86	1.86	0	1
NASS-108-S-2001	SENTINEL	MILLVILLE CR	WORCESTER	1	COASTAL-E	4.36	0.182	5.479	27.625	ORG	77.82	2.25	1.29	1.29	0	1
NASS-302-S-2001	SENTINEL	NASSAWANGO CR	WORCESTER	3	COASTAL-E	6.25	0.252	7.297	12.198	ORG & AD	71.66		3.29	3.29	0	1
UPCK-113-S-2001	SENTINEL	UT CHOPTANK R	CAROLINE	1	COASTAL-E	6.12	0.303	10.977	17.414	ORG & AD	61.00	2.50	2.71	2.71	0	1
WIRH-220-S-2001	SENTINEL	LEONARD MILL RUN	WICOMICO	2	COASTAL-E	6.76	3.860	5.137	3.652	none	51.41	3.25	4.43	3.84	0	0
DIVI-104-R-2001		TONY CR	SOMERSET	1	COASTAL-E	4.89	0.513	9.007	14.035	ORG & AD	84.79	3.25	1.57	2.41	0	1
DIVI-110-R-2001		DIVIDING CR	WICOMICO	1	COASTAL-E	5.84	0.305	10.228	16.090	ORG & AD	77.75		2.14	2.14	0	1
DIVI-112-R-2001		POLLITTS BR	SOMERSET	1	COASTAL-E	6.08	0.255	7.423	5.942	AD	63.13	3.75	3.29	3.52	0	0
DIVI-119-R-2001		MILLER BR	WORCESTER	1	COASTAL-E	4.17	0.001	9.196	19.677	ORG & AD	88.53	1.00	1.86	1.86	0	1
DIVI-218-R-2001		DIVIDING CR	WORCESTER	2	COASTAL-E	6.16	1.033	8.946	9.512	ORG & AD	72.45	3.50	4.14	3.82	0	1
NASS-217-R-2001		NASSAWANGO CR	WICOMICO	2	COASTAL-E	6.63	1.246	12.018	9.984	ORG & AD	59.62	3.25	3.86	3.55	0	1
UPPC-117-R-2001		FIVEMILE BR	WORCESTER	1	COASTAL-E	5.00	0.098	16.598	32.876	ORG & AD	91.34	1.00	2.71	2.71	0	1
MATT-033-S-2001	SENTINEL	MATTAWOMAN CR	CHARLES	1	COASTAL-W	6.72	0.115	11.134	3.497	AD	69.69	3.00	3.29	3.14	0	0
NANJ-331-S-2001	SENTINEL	MILL RUN	CHARLES	3	COASTAL-W	6.66	0.236	10.836	1.648	AD	81.36	2.50	4.71	3.61	0	0
PAXL-294-S-2001	SENTINEL	SWANSON CR	CHARLES	2	COASTAL-W	6.94	0.424	14.800	1.864	AD	69.82	3.00	4.14	3.57	0	0
PTOB-002-S-2001	SENTINEL	HOGHOLE RUN	CHARLES	1	COASTAL-W	6.59	0.001	9.788	1.523	AD	82.68	4.25	3.86	4.05	0	0
STCL-051-S-2001	SENTINEL	ST CLEMENTS UT	ST. MARY'S	1	COASTAL-W	6.96	0.001	6.558	2.560	none	74.93		4.71	4.71	0	0
ZEKI-012-S-2001	SENTINEL	UT ZEKIAH SWAMP RUN	CHARLES	1	COASTAL-W	6.66	0.214	7.363	1.740	AD	93.04	3.50	4.14	3.82	0	0
GILB-101-R-2001		LANCASTER RUN	CHARLES	1	COASTAL-W	6.64	1.084	11.141	1.881	AD	55.01	2.75	3.57	3.16	0	0
GILB-111-R-2001		ODEN RUN	CHARLES	1	COASTAL-W	6.91	1.575	17.181	1.740	AD	52.20	2.75	4.71	3.73	0	0
GILB-115-R-2001		SMOOTS POND RUN	CHARLES	1	COASTAL-W	6.55	1.517	11.832	3.223	AD	54.49	5.00	2.71	3.86	0	0
GILB-306-R-2001		GILBERT SWAMP RUN	CHARLES	3	COASTAL-W	6.92	0.732	12.806	3.512	AD	60.85	3.00	3.86	3.43	0	0
GILB-307-R-2001		GILBERT SWAMP RUN	CHARLES	3	COASTAL-W	6.74	0.739	12.497	3.007	none	62.58	3.50	3.86	3.68	0	0
PAXM-106-R-2001		UT MATAPONI CR	PRINCE GEORGES	1	COASTAL-W	6.26	0.376	19.080	3.383	AD	62.95	4.00	4.14	4.07	0	0
PAXM-211-R-2001		MATAPONI CR	PRINCE GEORGES	2	COASTAL-W	6.64	0.705	32.195	3.087	AD	52.07	3.00	3.57	3.29	0	0
PRUT-117-R-2001		UT POTOMAC RIVER	CHARLES	1	COASTAL-W	4.91	0.001	14.433	9.081	ORG & AD	96.12		1.57	1.57	0	1
ZEKI-104-R-2001		UT ZEKIAH SWAMP RUN	CHARLES	1	COASTAL-W	6.64	0.272	7.132	1.766	AD	93.77	3.75	3.86	3.80	0	0
ZEKI-109-R-2001		UT ZEKIAH SWAMP RUN	CHARLES	1	COASTAL-W	6.68	1.122	12.425	2.562	AD	53.82	2.75	3.29	3.02	0	0
ZEKI-114-R-2001		UT ZEKIAH SWAMP RUN	CHARLES	1	COASTAL-W	6.63	0.998	12.072	2.475	AD	54.49	3.00	3.86	3.43	0	0
ZEKI-215-R-2001		UT ZEKIAH SWAMP RUN	CHARLES	2	COASTAL-W	6.66	0.926	13.173	1.824	AD	56.72	4.75	4.14	4.45	0	0
ZEKI-302-R-2001		ZEKIAH SWAMP RUN	CHARLES	3	COASTAL-W	6.11	0.320	11.180	3.581	AD	59.46	4.25	3.57	3.91	0	0
ZEKI-305-R-2001		ZEKIAH SWAMP RUN	CHARLES	3	COASTAL-W	6.55	0.356	10.359	4.606	AD	58.98	4.25	4.71	4.48	0	0
ZEKI-307-R-2001		ZEKIAH SWAMP RUN	CHARLES	3	COASTAL-W	6.12	0.307	8.668	3.572	AD	73.04	4.00	3.86	3.93	0	0
ZEKI-312-R-2001		ZEKIAH SWAMP RUN	CHARLES	3	COASTAL-W	6.73	0.246	10.686	3.740	AD	62.78	3.75	3.57	3.66	0	0
FURN-101-S-2001	SENTINEL	WINCH RUN (BUCK SWAMP CR)	CECIL	1	EPIEDMNT	6.78	0.622	4.882	3.074	AD	86.46	3.89	4.11	4.00	0	0
JONE-109-S-2001	SENTINEL	UT DIPPING POND RUN	BALTIMORE	1	EPIEDMNT	6.67	2.921	1.138	1.091	none	76.78		4.11	4.11	0	0
JONE-315-S-2001	SENTINEL	NORTH BR JONES FALLS	BALTIMORE	3	EPIEDMNT	8.20	1.522	4.298	1.134	none	55.31	3.44	3.00	3.22	0	0
LIBE-102-S-2001	SENTINEL	TIMBER RUN	BALTIMORE	1	EPIEDMNT	7.14	1.272	4.273	1.140	none	74.67	3.22	3.44	3.33	1	0
LOCH-120-S-2001	SENTINEL	BAISMAN RUN	BALTIMORE	1	EPIEDMNT	7.14	1.658	2.888	0.790	AD	59.81	2.56	4.33	4.33	1	0
RKGR-119-S-2001	SENTINEL	UT PATUXENT R	HOWARD	1	EPIEDMNT	6.81	1.648	5.922	1.077	none	65.20	3.44	4.11	3.78	0	0
DEER-113-R-2001		WET STONE BR	HARFORD	1	EPIEDMNT	7.07	2.137	3.491	1.052	AD	60.24	4.33	4.78	4.56	1	0
LIBE-103-C-2001		COOKS BR	BALTIMORE	1	EPIEDMNT	7.38	1.090	7.786	1.238	none	75.53	3.22	5.00	4.11	1	0
LIBE-204-C-2001		COOKS BR	BALTIMORE	2	EPIEDMNT	7.35	1.119	7.702	0.952	none	74.40	3.67	4.33	4.00	1	0
LIGU-105-R-2001		UT LITTLE GUNPOWDER FALLS	HARFORD	1	EPIEDMNT	7.74	2.848	11.077	1.164	none	50.70		4.56	4.56	0	0
NEAS-107-R-2001		UT STONY RUN	CECIL	1	EPIEDMNT	6.86	0.409	7.112	2.510	AD	70.07	3.22	3.89	3.56	0	0

Table D-4. (Continued)

SITE	SITE TYPE	STREAM NAME	COUNTY	ORDER	STRATA_R	PH_ LAB	NO3_ LAB	SO4_ LAB	DOC_ LAB	ACID SOURCE	PERCENT FOREST	FIBI	BIBI	CBI	BRKTROUT	BLACKWAT
FIMI-207-S-2001	SENTINEL	FIFTEENMILE CR	ALLEGANY	2	HIGHLAND	7.10	0.402	8.793	0.898	AD	89.51	3.57	3.44	3.51	0	0
PRLN-626-S-2001	SENTINEL	MILL RUN	ALLEGANY	6	HIGHLAND	7.67	0.841	12.188	0.878	none	100.00	3.86	4.11	3.98	1	0
SAVA-159-S-2001	SENTINEL	MIDDLEFORK RUN	GARRETT	1	HIGHLAND	7.12	0.774	12.592	0.548	AD	90.15	4.14	4.33	4.24	1	0
SAVA-225-S-2001	SENTINEL	SAVAGE R	GARRETT	2	HIGHLAND	7.22	0.917	10.399	1.173	AD	83.84	4.14	3.67	3.90	1	0
SAVA-276-S-2001	SENTINEL	DOUBLE LICK RUN	GARRETT	2	HIGHLAND	6.76	0.542	10.703	0.284	AD	91.01	4.14	3.89	4.02	1	0
UMON-288-S-2001	SENTINEL	UT HUNTING CR	FREDERICK	2	HIGHLAND	6.52	0.396	3.656	0.678	AD	87.89	2.43	4.33	4.33	1	0
YOUG-432-S-2001	SENTINEL	BEAR CR	GARRETT	4	HIGHLAND	6.47	1.023	8.589	0.956	AD	76.35	4.14	4.56	4.35	1	0
ANTI-101-C-2001		UT EDGEWOOD RESERVOIR	WASHINGTON	1	HIGHLAND	7.50	0.867	10.479	1.331	none	86.55	2.14	5.00	5.00	1	0
PRAL-106-R-2001		UT POTOMAC R	ALLEGANY	1	HIGHLAND	6.77	0.371	14.279	1.879	AD	100.00		3.44	3.44		
PRUN-102-R-2001		McMILLAN FORK OF SHIELDS RUN	GARRETT	1	HIGHLAND	7.07	0.713	27.252	0.677	none	89.22	1.57	4.56	4.56	1	0
PRUN-103-R-2001		FOLLY RUN	GARRETT	1	HIGHLAND	6.69	0.685	11.055	0.496	AD	96.47	3.57	3.44	3.51	1	0
PRUN-107-R-2001		FOLLY RUN	GARRETT	1	HIGHLAND	6.63	0.609	11.047	0.622	AD	96.63	3.00	4.11	3.56	1	0
SAVA-101-C-2001		MONROE RUN	GARRETT	1	HIGHLAND	7.13	0.605	11.717	0.532	AD	95.88	4.43	4.56	4.49	0	0
SAVA-202-C-2001		POPLAR LICK RUN	GARRETT	2	HIGHLAND	6.78	0.602	7.756	0.986	AD	91.54	3.29	3.67	3.48	1	0
SAVA-203-C-2001		POPLAR LICK RUN	GARRETT	2	HIGHLAND	6.90	0.608	10.027	0.631	AD	93.35	4.43	4.56	4.49	1	0
SAVA-204-C-2001		CRABTREE CR	GARRETT	2	HIGHLAND	7.37	0.707	12.914	0.578	none	89.30	3.86	4.33	4.10	1	0
SIDE-109-R-2001		UT SIDELING HILL CR	ALLEGANY	1	HIGHLAND	7.46	1.351	14.993	1.830	none	94.23		3.44	3.44	0	0
SIDE-402-R-2001		SIDELING HILL CR	ALLEGANY	4	HIGHLAND	7.24	0.621	11.173	1.589	AD	76.32	4.43	4.11	4.27	0	0
SIDE-405-R-2001		SIDELING HILL CR	WASHINGTON	4	HIGHLAND	6.98	0.670	11.072	1.534	AD	74.83	4.14	3.22	3.68	0	0
SIDE-410-R-2001		SIDELING HILL CR	WASHINGTON	4	HIGHLAND	6.70	0.641	11.201	1.390	AD	75.04	3.86	4.33	4.10	0	0
UMON-101-C-2001		LITTLE FISHING CR	FREDERICK	1	HIGHLAND	6.67	0.256	1.733	0.637	AD	99.49	4.43	4.56	4.49	1	0
YOUG-106-R-2001		UT LITTLE BEAR CR	GARRETT	1	HIGHLAND	7.35	0.723	11.026	0.636	none	89.29	4.14	3.67	3.90	1	0
YOUG-107-R-2001		UT YOUGHIOGHENY R	GARRETT	1	HIGHLAND	6.96	0.830	7.224	0.560	AD	77.59		3.89	3.89	0	0
YOUG-117-R-2001		MILL RUN	GARRETT	1	HIGHLAND	6.95	1.360	6.580	0.791	AD	75.75	4.43	4.33	4.38	1	0
YOUG-123-R-2001		UT MILL RUN	GARRETT	1	HIGHLAND	6.07	0.912	13.312	0.942	AD	84.75	3.57	4.78	4.17	1	0
YOUG-127-R-2001		UT LITTLE BEAR CR	GARRETT	1	HIGHLAND	7.28	0.676	11.129	0.710	AD	91.46	3.86	3.89	3.87	1	0
YOUG-208-R-2001		BEAR BR	GARRETT	2	HIGHLAND	6.90	1.477	9.066	1.646	AD	57.71	3.57	4.78	4.17	1	0
YOUG-214-R-2001		YOUGHIOGHENY R	GARRETT	2	HIGHLAND	7.12	0.927	6.716	1.088	AD	70.20	3.29	4.11	3.70	0	0
YOUG-219-R-2001		YOUGHIOGHENY R	GARRETT	2	HIGHLAND	7.00	1.032	6.697	1.010	AD	66.34	3.00	3.89	3.44	0	0
YOUG-320-R-2001		MUDDY CR	GARRETT	3	HIGHLAND	6.69	0.359	6.995	1.644	AD	74.17	3.00	4.78	3.89	0	0

Table D-5. Comparisons of MBSS Round 1, 2000, and 2001 results for selected parameters at Sentinel sites during both rounds of the Survey

SITE (95-97)	SITENEW	SAMPLED	STREAM NAME	ORDER	STRATA_R	PH_ LAB	NO3_ LAB	SO4_ LAB	DOC_ LAB	ACIDSRC	PERCENT FOREST	FIBI	BIBI	CBI	BKTRFLAG	BLACKWAT
KE-N-096-102-95	LOCR-102-S-1995	1995	SWAN CREEK	1	COASTAL-E	5.86	0.120	17.460	20.000	ORG & AD	70.33	2.75	1.86	1.86	0	1
	LOCR-102-S-2000	2000	SWAN CREEK	1	COASTAL-E	6.02	0.085	4.943	33.182	ORG	85.19	2.75	1.29	1.29	0	1
	LOCR-102-S-2001	2001	SWAN CREEK	1	COASTAL-E	5.92	0.169	7.821	20.150	ORG	85.19	2.75	1.86	1.86	0	1
WO-S-038-108-97	NASS-108-S-1997	1997	MILLVILLE CREEK	1	COASTAL-E	4.40	0.350	3.990	32.900	ORG	83.23	3.25	1.29	2.27	0	1
	NASS-108-S-2000	2000	MILLVILLE CREEK	1	COASTAL-E	4.41	0.082	3.405	36.061	ORG	77.82	2.00	1.00	1.00	0	1
	NASS-108-S-2001	2001	MILLVILLE CREEK	1	COASTAL-E	4.36	0.182	5.479	27.625	ORG	77.82	2.25	1.29	1.29	0	1
CN-N-024-113-96	UPCK-113-S-1996	1996	SKELETON CREEK	1	COASTAL-E	5.95	0.600	15.900	15.900	ORG & AD	61.01	2.75	2.14	2.14	0	1
	UPCK-113-S-2000	2000	SKELETON CREEK	1	COASTAL-E	5.53	0.117	6.413	28.632	NONE	61.01	2.25	2.71	2.71	0	1
	UPCK-113-S-2001	2001	SKELETON CREEK	1	COASTAL-E	6.12	0.303	10.977	17.414	ORG & AD	61.00	2.50	2.71	2.71	0	1
WI-S-063-220-95	WIRH-220-S-1995	1995	LEONARD POND RUN	2	COASTAL-E	6.64	2.080	5.280	6.000	NONE	56.48	3.25	3.00	3.12	0	0
	WIRH-220-S-2000	2000	LEONARD POND RUN	2	COASTAL-E	6.23	0.548	1.734	16.032	NONE	51.41	3.25	3.57	3.41	0	1
	WIRH-220-S-2001	2001	LEONARD POND RUN	2	COASTAL-E	6.76	3.860	5.137	3.652	NONE	51.41	3.25	4.43	3.84	0	0
QA-N-086-118-95	WYER-118-S-1995	1995	UT WYE EAST RIVER	1	COASTAL-E	6.80	1.160	13.260	22.000	NONE	57.09	3.00	3.86	3.43	0	0
	WYER-118-S-2000	2000	UT WYE EAST RIVER	1	COASTAL-E	6.89	1.330	9.818	26.695	NONE	55.39	2.75	3.00	2.88	0	0
	CORS-102-R-2000	2000	KIRBY CREEK	1	COASTAL-E	6.35	0.164	5.435	17.384	NONE	89.92	1.75	3.29	3.29	0	1
	CORS-102-S-2001	2001	KIRBY CREEK	1	COASTAL-E	6.56	0.440	8.241	8.682	ORG & AD	89.92	1.75	2.71	2.71	0	1
	NASS-302-S-2001	2001	NASSAWANGO CREEK	3	COASTAL-E	6.25	0.252	7.297	12.198	ORG & AD	71.66		3.29	3.29	0	1
CH-S-033-314-95	MATT-033-S-1995	1995	MATTAWOMAN CREEK	3	COASTAL-W	6.60	0.240	12.840	4.000	AD	69.63	3.50	2.71	3.10	0	0
	MATT-033-S-2000	2000	MATTAWOMAN CREEK	3	COASTAL-W	6.73	0.137	9.472	6.957	NONE	70.03	3.50	3.86	3.68	0	0
	MATT-033-S-2001	2001	MATTAWOMAN CREEK	3	COASTAL-W	6.72	0.115	11.134	3.497	AD	69.69	3.00	3.29	3.14	0	0
CH-S-331-304-95	NANJ-331-S-1995	1995	MILL RUN	3	COASTAL-W	6.46	0.330	11.610	3.000	AD	81.14	4.75	3.86	4.30	0	0
	NANJ-331-S-2000	2000	MILL RUN	3	COASTAL-W	6.47	0.164	10.634	3.087	ORG	81.25	3.00	3.57	3.28	0	0
	NANJ-331-S-2001	2001	MILL RUN	3	COASTAL-W	6.66	0.236	10.836	1.648	AD	81.36	2.50	4.71	3.61	0	0
CH-S-294-236-97	PAXL-294-S-1997	1997	SWANSON CREEK	2	COASTAL-W	6.85	0.600	14.760	2.500	AD	69.33	4.25	3.57	3.91	0	0
	PAXL-294-S-2000	2000	SWANSON CREEK	2	COASTAL-W	6.70	0.313	14.736	3.106	ORG	69.71	3.00	3.86	3.43	0	0
	PAXL-294-S-2001	2001	SWANSON CREEK	2	COASTAL-W	6.94	0.424	14.800	1.864	AD	69.82	3.00	4.14	3.57	0	0
CH-S-002-207-95	PTOB-002-S-1995	1995	HOGHOLE RUN	2	COASTAL-W	6.62	0.200	10.510	3.000	AD	83.58	4.50	3.29	3.90	0	0
	PTOB-002-S-2000	2000	HOGHOLE RUN	2	COASTAL-W	6.46	0.000	9.926	3.446	NONE	83.55	4.25	3.57	3.91	0	0
	PTOB-002-S-2001	2001	HOGHOLE RUN	2	COASTAL-W	6.59	0.001	9.788	1.523	AD	82.68	4.25	3.86	4.05	0	0
SM-S-051-132-95	STCL-051-S-1995	1995	UT ST CLEMENTS CREEK	1	COASTAL-W	6.86	0.200	7.050	4.000	NONE	79.26		3.86	3.86	0	0
	STCL-051-S-2000	2000	UT ST CLEMENTS CREEK	1	COASTAL-W	7.03	0.000	6.053	3.436	NONE	74.93		3.57	3.57	0	0
	STCL-051-S-2001	2001	UT ST CLEMENTS CREEK	1	COASTAL-W	6.96	0.001	6.558	2.560	NONE	74.93		4.71	4.71	0	0
CA-S-086-209-97	WCHE-086-S-1997	1997	PLUM POINT CREEK	2	COASTAL-W	7.36	0.000	16.210	3.200	NONE	74.93	2.75	3.29	3.02	0	0
	WCHE-086-S-2000	2000	PLUM POINT CREEK	2	COASTAL-W	7.07	0.061	14.256	5.199	NONE	74.61	2.00	2.14	2.07	0	0
	WCHE-086-S-2001	2001	PLUM POINT CREEK	2	COASTAL-W	7.35	0.229	16.837	2.851	NONE	73.87	1.75	3.00	2.38	0	0
CH-S-012-114-95	ZEKI-012-S-1995	1995	UT ZEKIAH SWAMP RUN	1	COASTAL-W	6.20	0.340	14.820	3.000	AD	95.19	3.75	4.43	4.09	0	0
	ZEKI-012-S-2000	2000	UT ZEKIAH SWAMP RUN	1	COASTAL-W	6.52	0.079	7.876	2.566	AD	92.95	3.25	4.14	3.70	0	0
	ZEKI-012-S-2001	2001	UT ZEKIAH SWAMP RUN	1	COASTAL-W	6.66	0.214	7.363	1.740	AD	93.04	3.50	4.14	3.82	0	0
BA-P-234-109-95	JONE-109-S-1995	1995	DIPPING POND RUN	1	EPIEDMNT	6.77	2.510	2.090	1.000	NONE	74.33		3.67	3.67	1	0
	JONE-109-S-2000	2000	DIPPING POND RUN	1	EPIEDMNT	6.41	2.386	2.660	0.792	NONE	76.78		4.11	4.11	0	0
	JONE-109-S-2001	2001	DIPPING POND RUN	1	EPIEDMNT	6.67	2.921	1.138	1.091	NONE	76.78		4.11	4.11	0	0

Table D-5. (Continued)

SITE (95-97)	SITENEW	SAMPLED	STREAM NAME	ORDER	STRATA_R	PH_ LAB	NO3_ LAB	SO4_ LAB	DOC_ LAB	ACIDSRC	PERCENT FOREST	FIBI	BIBI	CBI	BKTRFLAG	BLACKWAT
BA-P-077-315-96	JONE-315-S-1996	1996	NORTH BR JONES FALLS	3	EPIEDMNT	7.60	1.320	7.360	2.600	NONE	56.62	3.00	3.67	3.34	0	0
	JONE-315-S-2000	2000	NORTH BR JONES FALLS	3	EPIEDMNT	7.52	1.066	6.174	2.007	NONE	56.29	3.22	4.33	3.78	0	0
	JONE-315-S-2001	2001	NORTH BR JONES FALLS	3	EPIEDMNT	8.20	1.522	4.298	1.134	NONE	55.31	3.44	3.00	3.22	0	0
BA-P-025-102-96	LOCH-102-S-1996	1996	BEAVERDAM RUN	1	EPIEDMNT	6.37	1.530	4.810	4.900	AD	56.69	3.44	3.22	3.33	1	0
	LOCH-102-S-2000	2000	BEAVERDAM RUN	1	EPIEDMNT	6.32	2.326	2.360	1.779	AD	56.60	3.00	4.33	4.33	1	0
BA-P-015-120-96	LOCH-120-S-1996	1996	BAISMANS RUN	1	EPIEDMNT	6.97	2.550	3.990	1.100	AD	58.59	1.89	4.33	4.33	1	0
	LOCH-120-S-2000	2000	BAISMANS RUN	1	EPIEDMNT	7.01	1.075	4.918	0.988	AD	62.99	2.78	3.22	3.22	1	0
	LOCH-120-S-2001	2001	BAISMANS RUN	1	EPIEDMNT	7.14	1.658	2.888	0.790	AD	59.81	2.56	4.33	4.33	1	0
BA-P-057-209-96	LOCH-209-S-1996	1996	GREENE BRANCH	2	EPIEDMNT	7.43	2.300	9.720	1.400	NONE	56.58	2.78	3.44	3.11	0	0
	LOCH-209-S-2000	2000	GREENE BRANCH	2	EPIEDMNT	7.54	1.745	10.518	1.229	NONE	53.91	3.22	3.67	3.44	0	0
HO-P-228-119-97	RKGR-119-S-1997	1997	UN TRIB TO PATUXENT R	1	EPIEDMNT	7.69	1.360	7.170	1.500	NONE	65.92	3.44	4.11	3.78	0	0
	RKGR-119-S-2000	2000	UN TRIB TO PATUXENT R	1	EPIEDMNT	7.49	1.205	7.586	1.564	AD	66.76	3.89	3.44	3.66	0	0
	RKGR-119-S-2001	2001	UN TRIB TO PATUXENT R	1	EPIEDMNT	6.81	1.648	5.922	1.077	NONE	65.20	3.44	4.11	3.78	0	0
	FURN-101-C-2000	2000	WINCH RUN (BUCK SWAMP CREEK)	1	EPIEDMNT	6.66	0.509	4.055	2.224	ORG	86.36	3.89	4.56	4.22	0	0
	FURN-101-S-2001	2001	WINCH RUN (BUCK SWAMP CREEK)	1	EPIEDMNT	6.78	0.622	4.882	3.074	AD	86.46	3.89	4.11	4.00	0	0
	LIBE-102-C-2000	2000	TIMBER RUN	1	EPIEDMNT	6.97	1.126	4.826	0.935	NONE	76.96	4.33	4.11	4.22	1	0
	LIBE-102-S-2001	2001	TIMBER RUN	1	EPIEDMNT	7.14	1.272	4.273	1.140	NONE	74.67	3.22	3.44	3.33	1	0
AL-A-207-307-95	FIMI-207-S-1995	1995	FIFTEENMILE CREEK	3	HIGHLAND	6.91	0.260	10.340	2.000	AD	89.73	2.71	4.11	3.41	0	0
	FIMI-207-S-2000	2000	FIFTEENMILE CREEK	3	HIGHLAND	7.09	0.196	9.015	2.211	AD	89.69	3.29	3.44	3.36	0	0
	FIMI-207-S-2001	2001	FIFTEENMILE CREEK	3	HIGHLAND	7.10	0.402	8.793	0.898	AD	89.51	3.57	3.44	3.51	0	0
AL-A-626-216-96	PRLN-626-S-1996	1996	MILL RUN	2	HIGHLAND	7.51	0.680	12.890	1.100	NONE	100.60	2.71	3.67	3.67	1	0
	PRLN-626-S-2000	2000	MILL RUN	2	HIGHLAND	7.56	0.443	13.174	0.987	NONE	100.00	3.57	4.56	4.07	1	0
	PRLN-626-S-2001	2001	MILL RUN	2	HIGHLAND	7.67	0.841	12.188	0.878	NONE	100.00	3.86	4.11	3.98	1	0
GA-A-159-202-96	SAVA-159-S-1996	1996	MIDDLE FORK RUN	2	HIGHLAND	6.83	0.720	14.050	1.000	AD	90.35	4.14	3.44	3.79	1	0
	SAVA-159-S-2000	2000	MIDDLE FORK RUN	2	HIGHLAND	7.03	0.425	13.162	0.789	AD	90.21	4.43	4.33	4.38	1	0
	SAVA-159-S-2001	2001	MIDDLE FORK RUN	2	HIGHLAND	7.12	0.774	12.592	0.548	AD	90.15	4.14	4.33	4.24	1	0
GA-A-999-302-96	SAVA-225-S-1996	1996	SAVAGE RIVER	3	HIGHLAND	7.07	0.800	12.030	1.500	AD	83.46	4.14	4.33	4.23	1	0
	SAVA-225-S-2000	2000	SAVAGE RIVER	3	HIGHLAND	7.26	0.452	11.607	2.449	NONE	83.87	3.57	4.78	4.18	1	0
	SAVA-225-S-2001	2001	SAVAGE RIVER	3	HIGHLAND	7.22	0.917	10.399	1.173	AD	83.84	4.14	3.67	3.90	1	0
GA-A-276-106-96	SAVA-276-S-1996	1996	DOUBLE LICK RUN	1	HIGHLAND	6.77	0.490	12.890	0.800	AD	92.12	4.71	3.67	4.19	1	0
	SAVA-276-S-2000	2000	DOUBLE LICK RUN	1	HIGHLAND	6.75	0.329	12.110	0.700	AD	92.64	4.14	4.33	4.24	1	0
	SAVA-276-S-2001	2001	DOUBLE LICK RUN	1	HIGHLAND	6.76	0.542	10.703	0.284	AD	91.01	4.14	3.89	4.02	1	0
FR-P-288-133-96	UMON-288-S-1996	1996	TRIB TO HUNTING CREEK	1	HIGHLAND	7.33	0.560	6.490	1.700	NONE	88.62	4.14	3.22	3.68	0	0
	UMON-288-S-2000	2000	TRIB TO HUNTING CREEK	1	HIGHLAND	6.52	0.163	3.653	1.603	NONE	81.63	2.43	4.33	4.33	1	0
	UMON-288-S-2001	2001	TRIB TO HUNTING CREEK	1	HIGHLAND	6.52	0.396	3.656	0.678	AD	87.89	2.43	4.33	4.33	1	0
GA-A-432-315-95	YOUG-432-S-1995	1995	BEAR CREEK	3	HIGHLAND	6.96	0.650	9.590	1.000	AD	76.12	4.14	4.11	4.12	1	0
	YOUG-432-S-2000	2000	BEAR CREEK	3	HIGHLAND	7.01	0.788	9.773	2.329	AD	76.25	3.86	4.78	4.32	1	0
	YOUG-432-S-2001	2001	BEAR CREEK	3	HIGHLAND	6.47	1.023	8.589	0.956	AD	76.35	4.14	4.56	4.35	1	0